

Current Science



Vol. XXI]

NOVEMBER 1952

[No. 11

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SCIENCE IN GENERAL EDUCATION*

TO appreciate the place which scientific studies occupy in education, it would be well to consider two separate kinds of education: on the one hand, general education, and on the other, specialized or professional training. In the latter, science crops up in a number of ways according to the more or less technical character of the career chosen, whereas in general education its place is always the same.

In reality, then, there are two problems and the role of education is not identical at each stage. It is in the course of so-called higher or professional education that great differences appear in the study of the sciences. The need to acquire the vast assortment of technical and theoretical knowledge required for all the professions nowadays unhappily obliges most young people—and I do not know if this is inevitable or not—to bypass all other subjects except those essential for their particular training.

It is upon primary and above all upon secondary education that the onus falls of providing

all young people with a grounding in science, not only in order to give them access to a technical or scientific career, but also to supply those destined for non-scientific activities with the minimum information necessary for life in modern society. It will save them from being non-plussed by the first problem with which their work itself will present them in a domain inevitably linked more or less closely with science. For future specialists, therefore, a judicious preparation at the secondary stage is extremely useful; but for those who do not intend to study science after matriculation, some scientific education before they reach that parting of the ways would seem to be really indispensable. It is thus especially for the benefit of the second group that we should endeavour to give all school children, before matriculation and while there is still time, a general outline of science, so as to awaken their interest in scientific achievements and thoroughly to acquaint their minds with scientific method. At this common stage of general education, it is much more important to develop the ability to learn than to accumulate items of knowledge.

If we are to succeed in this task, we must firmly reject every proposal for dividing science

* Abstract of the Address by Dr. Jaime Torres Bodet, Director-General of UNESCO, at the Conference on Public Education held in Geneva from 7th to 16th July,

subjects between secondary and higher education. There is no reason to tire and discourage students by obliging them to follow all the historical and technical by-paths that the pioneers had perforce to tread. Science as taught must be living science. Great highways have been marked out, and we must make use of these without hesitation.

The ideal would be to ensure that young people leave school or secondary school, or college, feeling that they have made a real contact, however brief, with the whole world of science; that they have enjoyed this contact, and that they are ready to renew it, without apprehension, whenever their profession or simply the course of events makes it necessary. By ceasing to be a mystery, science will not lose any of its prestige. It will gain in human

value and without it, there will no longer be a general culture.

This project to make science a part of general culture in no way offends humanism in the strict sense. The traditional cultural values, if they are to hold their own against the imperialistic tendencies of technology, must be receptive to scientific knowledge, from which technology springs. They will not save themselves, nor preserve their influence, by isolation from research and discoveries which characterize modern thought. I have enough faith in the cultural values to know that they have nothing to fear from a broad contact with the sciences. For science has not only affected the material side of civilization but has also been a creative force in its own right.

RADIATION AND MACROMOLECULES

AN International Symposium on the above subject was held in Strasbourg, France, from June 9 to June 12, 1952. The following points discussed during the session deserve special mention:

(a) The light-scattering method is based on absolute measurements of the scattered intensity by certain standard materials; they can be solutions of ordinary organic molecules of known constitution, selected polymeric materials of known molecular weight and molecular weight distribution or colloidal particles of great homogeneity and exactly known size. A thorough discussion of the relative merits of the different calibration procedures seems to indicate that well-defined organic molecules such as hexachlorobenzene in benzene or toluene offer a very good opportunity for reliable calibration.

(b) A thorough discussion of the best methods to purify polymer solutions and prepare them for precise light-scattering experiments led to the conclusion that each individual system polymer-solvent requires special study and discussion. In general it appears that a combination of filtration and centrifugation gives the best results. Special precautions were recommended to avoid contamination of the solutions during the filling of the cell.

(c) An animated discussion developed on the light-scattering from poly-electrolyte solutions and on the configuration of such molecules at different concentrations and at different pH values. The Alfrey-Morawetz solution of the Poisson-Boltzmann equation for rod-shaped particles in cylinder co-ordinates was presented and its consequences for the distribution of the mobile counter ions were discussed.

(d) New results on the optical analysis of soap solutions and of colloidal emulsions were presented; the size and shape of the soap micelles were determined for various soap concentrations, temperatures, pH values and various amounts of added neutral salts.

(e) Two new precision light-scattering instruments were described and numerical data obtained with them were presented; a new and very sensitive differential refractometer was described and its application was demonstrated.

(f) Polymethyl- and polyethyl-silicones ranging from very low (300) to very high (1,000,000) molecular weights were indicated by a combination of the osmotic, light-scattering and viscosity methods. The results together with the mechanical properties of these specimens indicate that polysilicones of this type consist not only of linear chain molecules but also contain interlaced rings of considerable size which cannot be separated from the linear components and are responsible for the unsatisfactory mechanical properties.

(g) The theory of small angle X-ray scattering was thoroughly discussed for the two extreme cases: (a) very dilute solutions of rod-like particles with cylindrical cross-section; and (b) closely packed systems of spheres and rigid rods.

(h) The intermicellar and intramicellar swelling of various types of cellulose with water was studied with X-rays and a significant difference in the behaviour of cellulose from cotton and various wood pulps was discovered.

The contributions will be published in one or two special issues of the *Journal of Polymer Science* late in 1952 or early in 1953.

NOBEL AWARD FOR PHYSICS, 1952

THE NOBEL PRIZE for Physics this year has been awarded jointly to Professor Felix Bloch of the University of Stanford and to Professor E. M. Purcell of the Harvard University, for their discovery of nuclear magnetic induction and nuclear magnetic resonance absorption respectively. These two independent, but complementary investigations have resulted in the establishment of the new field of research known as "nuclear magnetic resonance".

The discovery of this phenomenon of nuclear magnetic resonance ranks supreme among the post-war discoveries in physics. The wealth of information yielded by such studies during the six years since its discovery has been enormous and about 400 papers have appeared on the subject from all over the world. The discovery set a new standard of accuracy in the measurement of nuclear magnetic moments and other related nuclear constants. The basic principles of the phenomenon are extremely simple and they had been sought for by earlier workers, but without success. But it was the elegant and essentially simple electronic techniques used by Bloch and Purcell which enabled them to detect the effect. In fact, the electronic techniques developed from investigations of nuclear

magnetic resonance have been a source of inspiration to workers in other fields of study as well.

Prof. F. Bloch, who is now 47, had his early training in various Continental schools of research and has been Professor of Physics at the University of Stanford, California, since 1937. His important original contributions to physics include studies in the electron theory of metals, quantum electrodynamics, magnetic moments of neutrons and lastly discovery of nuclear induction, which forms the basis for the award of the Nobel Prize. Prof. Bloch's paper on Nuclear Induction is a model of scientific exposition and every serious student of science will profit from a study of it.

Professor Edward Mills Purcell, born in 1912, studied both in America and Germany. His early work was on the magnetic cooling of substances. During the last war he made many important contributions to the development of radar. He is now Professor of Physics at the Harvard University. His discovery of nuclear magnetic resonance absorption and its application to the study of crystals has opened up a field of study which is likely to bear fruit for a long time to come.

G. SURYAN.

NOBEL AWARD FOR CHEMISTRY, 1952

DRS. A. J. P. MARTIN AND R. L. M. SYNGE who share the Nobel Prize for Chemistry in 1952 represent British achievements in chromatography, which have earned the admiration of the scientific world, and have stimulated extensive researches on the application of this technique in all branches of chemistry. The announcement of the award is a fitting recognition of a series of investigations carried out by them jointly on partition chromatography, a new technique evolved by them, its application to the study of protein constituents and the introduction of a new micro-analytical procedure for the isolation, identification and determination of amino acids and peptides in protein hydrolysates.

Dr. Martin and Dr. Synge belong to the younger school of British chemists. For some time Dr. Martin worked in the Dunn Biochemical and Nutritional Laboratories, Cambridge, as Grocer's research scholar and later joined the Wool Industries Research Association, Leeds, as a biochemist in 1938. He is now at the National Institute for Medical Research, London. It was at the laboratories of the Wool Industries Research Association that he, in collaboration

with Dr. Synge, first developed partition chromatography. The preliminary stages of this work was carried out by Dr. Synge in the Dunn Biochemical Laboratory, Cambridge. Dr. Synge worked for some time in the Lister Institute, London, and later in the laboratories of the Wool Industries Research Association. He is now at the Rowett Research Institute, Aberdeenshire.

An entirely new principle was introduced into chromatography by Martin and Synge in 1941 and termed "partition chromatography" in order to distinguish it from the classical adsorption chromatography invented by the Russian botanist, Tswett, in 1906. The separation of substances is achieved by their differences in partition coefficients between aqueous and non-aqueous phases of the components of a mixture. They constructed a complicated multi-plate counter current liquid-liquid extraction machine and used it for the analysis of amino-acids. Later, they devised an ingenious method to hold one of the phases (water) by using a column packed with an inert support (e.g., silica gell) and to allow the immiscible solvent to pass through the water containing

silica gel. They used this new technique to effect a separation of the various acetyl amino acids. They successfully applied these techniques to the study of the amino acid composition of proteins like gelatin and polypeptide bactericidal substances, gramicidine and tyrocidine.

In 1944, considering the limitations of the above technique for the separation of free amino acids, Dr. Martin in collaboration with Dr. Consden and Dr. A. H. Gordon developed a very ingenious modification of partition chromatography, which has found enormous application since its introduction and has become the most valuable of all chromatographic techniques. For this technique, the silica gel column is replaced by filter-paper as the inert support. The great popularity of this new technique, known as paper-partition chromatography,

as an analytical tool is a tribute to the originality and ingenuity of Dr. Martin and it has led to one of the most remarkable advances on record in analytical technique.

There is an intimate connection between the researches of Dr. Martin and Dr. Synge. On the one hand, the earlier work of Dr. Synge on the partition coefficients of acetyl derivatives of amino acids formed the basis of the scheme of separation of amino acids by him, in close collaboration with Dr. Martin. On the other hand, it is the work of Dr. Martin who working in Dunn Nutritional Laboratory, Cambridge, constructed the counter current extraction machine for vitamin purification, which brought the two chemists together to evolve new techniques in partition chromatography.

K. V. GIRI.

ELECTRONIC STERILISATION OF PHARMACEUTICAL PRODUCTS

THE possibility of using high velocity electrons for killing bacteria and other micro-organisms on a commercial scale has been investigated in the United States of America for several years, particularly regarding potential applications in the food and pharmaceutical industries. More recent developments have been concerned with the use of the radiations from radio-active atomic fission products, the waste products from atomic energy projects. The main advantage of the process is that sterilisation of a wide variety of products is possible, within severe practical limits, without the extensive damage associated with heat or chemical sterilisation. Small amounts of chemical side-effects occur which are frequently objectionable, but these can be reduced by suitable choice of technique. A certain amount of work has also been carried out by the Food Investigation Organization of the D.S.I.R., England.

The use of high velocity electrons and gamma rays has been studied by various workers. The former were obtained from electron accelerators with effective anode voltages usually upto 2 or 3 million volts; upto 15 million volts had been used, however. Gamma rays were obtained from radio-active sources; Cobalt 60, which was being used experimentally, gave radiation with an energy of about 1 Mev. It is important to note that these energies are insufficient to induce radio-activity in irradiated products.

The biological effects of these radiations have

been studied intensively and the ability to kill bacteria has been proved, the general principle being that large organisms are more easily killed than small. The most extensive and reliable figures available had been published by the Department of Food Technology of the Massachusetts Institute of Technology. Their observed sterilisation doses were approximately:

Insects	100,000 rep.
Vegetative Bacteria ..	500,000 rep.
Moulds and Yeasts ..	1,000,000 rep.
Bacterial Spores ..	2,000,000 rep.

the "rep" being a very small unit based on the number of ions produced by the radiation. 1,000,000 rep. gave a temperature rise of approximately 2° C. in water under adiabatic conditions. For the present, the general principle should be to determine the sterilisation dose for any given product by direct experiment. In some cases an incomplete kill might be accepted, with a considerable reduction in the dose necessary, but this possibility should be regarded with reserve until the subject has been more fully explored. Viruses usually required larger doses for their destruction, upto 5,000,000 rep. and enzymes even larger, upto 10,000,000 rep. or more, depending on their size. Toxins, etc., would in general be even more resistant. The advantages of the process are: (a) The sterilisation of heat sensitive materials would be possible. (b) Almost any type of sealed container could be used. (c) In some cases new products might be prepared, e.g., new vaccines.

EMIL FISCHER—BIRTH CENTENARY*

EMIL FISCHER was born on 9th October 1852, in Euskirchen in Rhenish Prussia. After the termination of his scholastic life he was appointed as instructor in the Strasbourg University. In 1875 he followed his teacher, von Baeyer to Munich where he worked successively as Lecturer, Professor Extraordinary and Director of the Analytical Department of von Baeyer's Laboratory. On the demise of von Hofmann in 1892, Emil Fischer was appointed Professor and Director of the Chemical Institute in Berlin University, a post which he filled with increasing distinction for 27 years until his death.

Fischer's investigations during the first 25 years of his research career mainly comprised work on colouring matters of the rosaniline group, phenyl hydrazine and its compounds with aliphatic and aromatic substances, separation and estimation of arsenic, caffeine, theobromine and xanthine, uric acid, syntheses in sugar group, glucosides, stereochemistry, estimation of amino acids and enzymes.

His investigation on the rosaniline bases led him to conclude that, (1) rosanilines producible from aniline and the toluidines are homologues of which the simplest, pararosaniline, has the composition $C_{19}H_{17}N_2$ whilst commercial fuchsine is a mixture of which the principal constituent is $C_{26}H_{19}N_2$ and that, (2) the parent hydrocarbon of the whole group is triphenyl methane of which or of its homologues, the various leucanilines are tri-amino derivatives.

Although Fischer started his career with research on colouring matter under his master, von Baeyer, he soon diverted and chalked out different lines of work for himself. In 1875 he observed that diazotised aniline on treatment with neutral potassium sulphite yielded, (i) potassium benzene diazonium sulphate, $C_6H_5N_2SO_3K$, and (ii) potassium phenyl hydrazino sulphate, $C_6H_5N_2H_2SO_3K$. The latter on treatment successively with benzyl chloride and hydrochloric acid yielded benzoic acid and phenyl hydrazine. Thus was born the 'key substance' phenyl hydrazine, which helped Fischer to reveal to us the story of the sugars. Today every student of organic chemistry knows the importance of phenyl hydrazine as a reagent for the identification of carbonyl compounds.

Fischer's major work soon excelled that of von Baeyer: a fact substantiated by the award (1902) of the Nobel Prize to the pupil three

years before it was awarded (1905) to the teacher. Fischer's discovery of organic hydrazines and the effect of phenylhydrazine on aldehydes and ketones led to the establishment of the constitution and to the synthesis of various sugars and to the unravelling of their stereochemistry. His investigations on lichenic substances, depsides and tannin materials have been considered very important. His discovery of soporifics and development of barbiturates like veronal helped the development of synthetic drugs. His investigations in Walden's inversion have become equally classical. Fischer's work on spider's silk revealed that its amino acid make-up is similar to that of natural silk, but while natural silk contained serine and α -anilino-propionic acid, spider silk contained glutamic acid. Perhaps the rudiments of modern paper chromatography are discernible in one of his papers entitled "Rise of salt solution in bibulous paper".

Fischer's main contribution to industry was the supply of trained personnel. In 1883 the Badische Factory in Germany offered him the lucrative position of the Directorship of the Company. But his love for research made him decline the offer. His development of the barbiturates, substitutes for atropine and strontium chloroarsenobenzenolale as remedy for carcinoma brought him in close contact with synthetic drug industry.

During the years of the First World War, Fischer's services were in constant demand for industrial and technical advice. He presided over two Commissions, one for the production of benzene and toluene, and the other for the utilisation of gypsum and kieserite for the production of sulphuric acid. It was he who as early as 1914 urged the need for the production of synthetic nitric acid from ammonia produced from coke ovens.

H. E. Armstrong, in the obituary article on Fischer, writes of him as "One of Germany's great academic experts—a man who was listened to and used by his Government and simply worshipped by industry". Emil Fischer's achievements will remain for all time a monument of perseverance and industry and a gospel of inspiration and encouragement to all that have the vision and courage to follow him.

* Summary of the Presidential Address, by Dr. B. H. Iyer to a Colloquium, held on 29th October 1952 in the Indian Institute of Science, Bangalore.

PRELIMINARY OBSERVATIONS ON THE PLANT MICROFOSSIL CONTENTS OF SOME LIGNITES FROM WARKALLI IN TRAVANCORE

A. R. RAO AND K. P. VIMAL

(University of Lucknow)

SOME samples of lignites from Warkalli, in Travancore, were obtained through the kind courtesy of the Secretary, Industries Section, Development Department of the Travancore-Cochin Government. These lignites which are regarded as Miocene by Krishnan,⁷ and which so far as we are aware, have not yet been studied, yielded on maceration a large number of micro-fossils like spores, pollen, cuticles, etc. The present note is a preliminary account of some of the representative types of these micro-fossils. A fuller paper on the subject is under preparation and will be published elsewhere. In this note are described just one type of *Monolete* spore, probably Pteridophytic and nine different types of pollen. These sporomorphs have been classed according to Erdtman³ as *Nona-perturites* *Tripurites*; *Triorites*; *Tetracolporites*; *Hexacolporites*; *Tricolpites*; *Septacolpites* and *Octacolpites*. The other terms used in the description of these pollen are borrowed from Erdtman,^{2,3,4} Sellings⁵ and Faegri and Iversen.⁶ Pollen measuring less than 35.7μ in both the polar and equatorial views are described as small, others exceeding this measurement are described as large. As far as possible both the polar and equatorial views have been described and sketched.

Technique.—The material was allowed to remain in strong nitric acid for atleast 12 hours. Then it was repeatedly washed in distilled water and subsequently treated with 10% KOH solution for 2 hours. As the macerated material still showed some silica remains like sand grains, some HF acid was added to it and heated on a sand-bath for an hour. The material was washed again, mounted in pure glycerine and sealed with Canada balsam.

Comparison.—The difficulty of comparing fossil pollen with living types is quite obvious. Still wherever it has been possible to institute a comparison with some degree of accuracy it has been done. *Betula nana*, *Cyrtandra lysiose-pala* (A. Gray) C. B. Clarke, amongst the pollen and *Thelypteris palustris* amongst the Pteridophytes offer such comparisons. Two of the sporomorphs described in the present note have also been found in the Palana lignites by Rao and Vimal,⁸ and also in the Salt Range (Dandot) lignites (Vimal, Mss.).

DESCRIPTION

Monolites spm. 1.—Grain large, heteropolar, bilateral, yellowish. Plano-convex in lateral view (Fig. 1; Photo 1) $47.6\mu \times 35.7\mu$. Narrow in proximal view (Fig. 2). Exine intectate with verrucate surface covered with dome-shaped small projections (Fig. 3) 5μ – 7μ apart. The grain can be referred to Polypodiaceae, and can be generally compared with the spore of *Thelypteris palustris* (Knox. E.M. 1951, p. 445, Fig. 30) with the difference that the projections are not pointed in our grain.

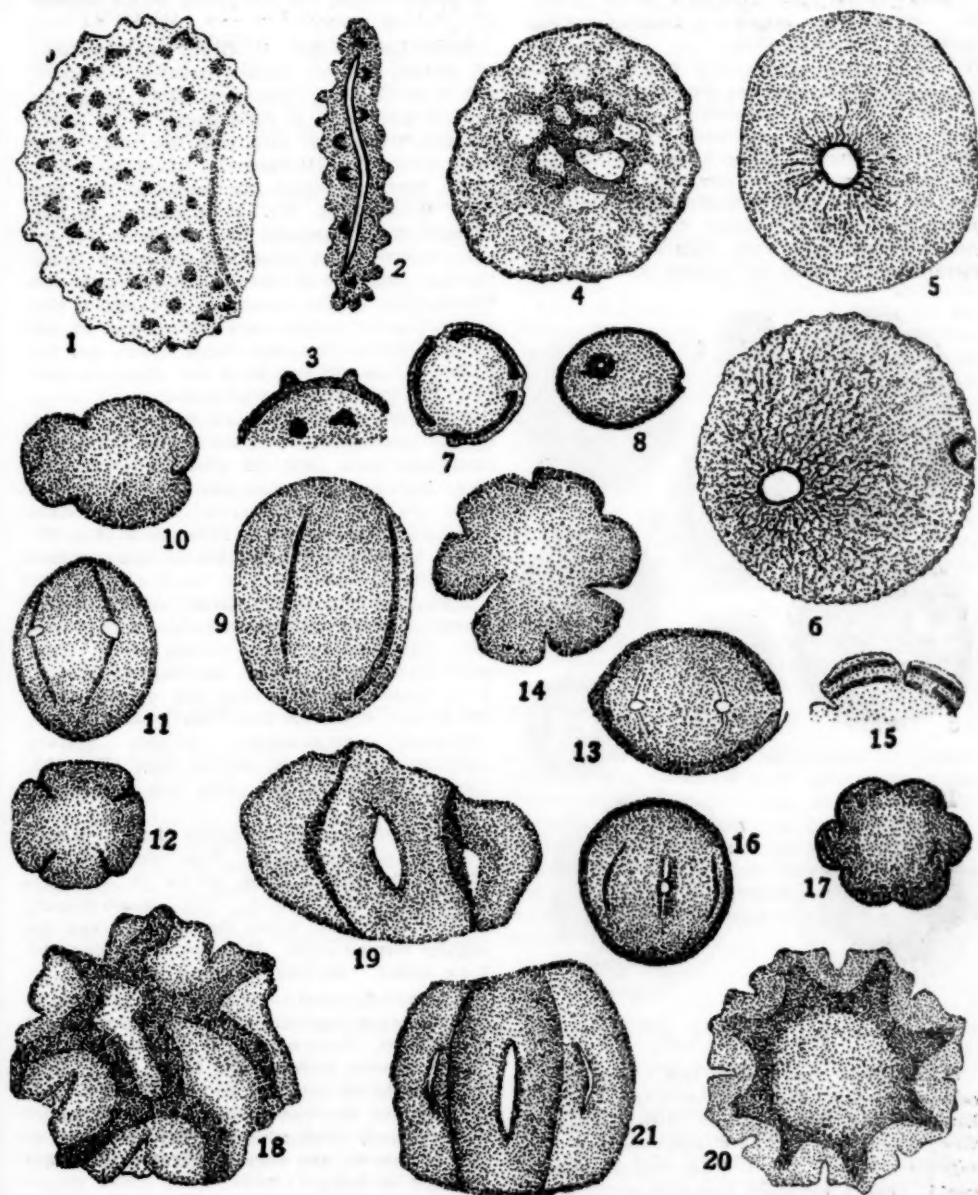
Reticulonapites spm. 1.—Grain large, brown, spherical (Fig. 4; Photo 2), apolar, radio-symmetric, 36.9μ across. Surface sculpture appears reticulate, intectate; columellae simple.

Tripurites spm. 1.—Grain large, yellowish, spherical (Fig. 5; Photo 3), flaccid, apolar, bilateral, $38.1\mu \times 41.6\mu$ across. Triporate, pores oval, $5.9\mu \times 7.1\mu$ in diameter. Fig. 5 and Photo 3 show one of the pores in focus. Fig. 6 shows the same grain after it has changed its position bringing the other two pores into view. The third pore is on the other side and is not shown in the sketch. Exine 1.2μ thick, surface sculpture striated.

Triorites spm. 1.—Grain small, yellowish, suboblate, isopolar, bilateral. Polar view (Fig. 7) round 17.9μ across. Pores three, small, equatorial, aspidate (annulate), 1.5μ in diameter. Equatorial view (Fig. 8; Photo 4), broadly elliptic, $14.3\mu \times 17.9\mu$ with one pore in focus. Ectoexine about one micron thin. Endoexine 1.2μ thick. Surface sculpture smooth, intectate. The grain resembles in size as well as shape the grain of *Betula nana* (Erdtman, 1943, p. 74, Figs. 63–65).

Tricolpites spm. 1.—Grain large, yellow, prolate, isopolar, bilateral. Equatorial view (Fig. 9; Photo 5), $35.7\mu \times 23.8\mu$, showing three flanges and two furrows. Furrows long and narrow, not reaching the poles. Polar view (Fig. 10) $17.9\mu \times 21.4\mu$, three-lobed. Endoexine 1.2μ thick, ectoexine very thin, less than a micron, surface sculpture intectate, smooth. The polar view of this grain resembles in size and surface sculpture the polar view of *Tricolpites* spm. figured by Mrs. Chitaley from the Mohgaon (Fig. 14, Text-Fig. 16).

Kalan deposits (Chitaley, 1951, p. 337, pl. 13,



FIGS. 1-21

FIGS. 1-3. *Monolites*, spm. 1. FIG. 4. *Reticulocarpites*, spm. 1. FIGS. 5-6. *Triporites*, spm. 1. FIGS. 7-8. *Triporites*, spm. 1. FIGS. 9-10. *Triaculporites*, spm. 1. FIGS. 11-12. *Tetraculporites*, spm. 1. FIGS. 13-15. *Hexaculporites*, spm. 1. FIGS. 16-17. *Hexaculporites*, spm. 2. FIGS. 18-19. *Septaculporites*, spm. 1. FIGS. 20-21. *Ostaculporites*, spm. 1.

Explanation of figures in text: All figures are magnified 1,300 times. Figs. 3 and 15 are semidiagrammatic, the rest are Camera lucida sketches.

Tetracolporites spm. 1.—Grain small, yellowish, subprolate, isopolar, radio-symmetric. Equatorial view (Fig. 11; Photo 6), $27.3\mu \times 21.4\mu$ oval, showing two porate-furrows on one side. Furrows long (longicollate), and pores broad (lati-porate), $2.4\mu \times 4.7\mu$. Polar view (Fig. 12), squarish, with the furrows at the angles. Exine 3.7μ thick, smooth. The grain resembles in form and dimensions also, the pollen from Hawaii referred to *Cyrindandra lysiosepala* (A. Gray) C. B. Clarke, by Selling (1947, pp. 284-85, Figs. 630-32). The *Tetracolporate* Hawaiian grains do not show

the pores clearly, but our pollen shows definite and distinct pores.

Hexacolporites spm. 1.—Grain small, yellowish, oblate, isopolar, radio-symmetric. Equatorial view (Fig. 13), biconvex, 33.4μ along the equator and 23.8μ at right angles to it. Poles rounded, colpae six, each with one small pore. Polar view (Fig. 14; Photo 7), round, six-lobed, 29.7μ across. Below the ectoexine are two more layers (Fig. 15). It is difficult to say whether they represent the endoexine or are only special extra layers of the exine itself. Surface sculpture granular. Hexacolpate and Pentacolpate pollen grains of the same size and surface sculpture have been found in the Palana lignites (Rao and Vimal, 1951), but the Palana grains did not show the colporate feature, nor the multi-layered exine.

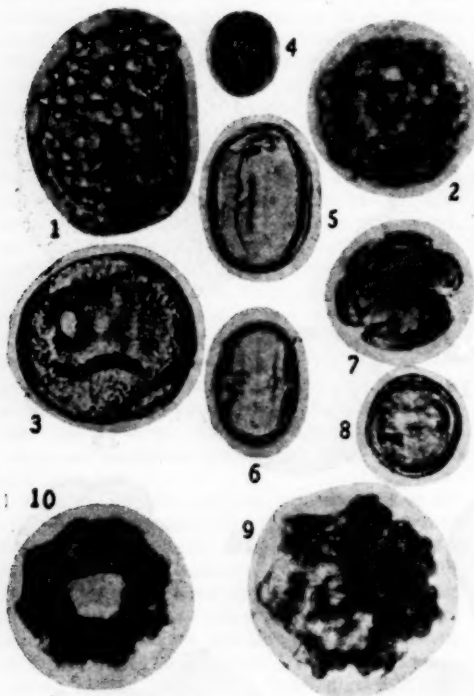
Hexacolporites spm. 2.—Grain small, brown, prolate spheroidal, isopolar, radio-symmetric. Equatorial view (Fig. 16; Photo 8) roundish, $21.4\mu \times 24.9\mu$ pores six, one in each furrow. Pores are big (grandi-porate) and the colpae are short (brevi-colpate). Polar view (Fig. 17) round, six-lobed, Exine 1.2μ , intexine granular, surface smooth.

Septacolpites spm. 1.—Grain large, brown, oblate, isopolar, radio-symmetric. Polar view (Fig. 18; Photo 9) 45.4μ across, round. Furrows seven, short, broad, meridianally placed, 4.7μ broad and 8.3μ long, but do not reach the poles. Ectoexine less than a micron thin, endoexine comparatively thicker. Surface sculpture rugulate. Equatorial view (Fig. 19), narrow, $28.5\mu \times 43.9\mu$, with one furrow in focus.

Octacolpites spm. 1.—Grain large, brown, isopolar, radio-symmetric. Polar view (Fig. 20; Photo 10), round, lobed, 41.4μ in diameter. Equatorial view (Fig. 21) drum-shaped, $35.7\mu \times 41.4\mu$ and shows the flat poles and the slightly convex sides. Furrows 11.9μ long and 1.2μ broad. Surface sculpture granular.

Acknowledgement.—We are deeply indebted to the Secretary, Industries Section, Development Department, Government of Travancore and Cochin, for the material and to Dr. R. C. Misra for drawing our attention to these lignites. This investigation was carried out during the tenure of a research scholarship enjoyed by one of us and to this we are very thankful to the Government of India.

I. Chitaley, S. D., *Proc. of the National Inst. of Sciences, India*, 1951, 17, No. 5, pp. 373-383. 2. Erdtman, G., *An Introduction to Pollen Analysis*, 1943, Waltham,



PHOTOGRAPHS 1-10

FIG. 1. Lateral view *Monolites*, spm. 1. FIG. 2. *Reticulonapites*, spm. 1. FIG. 3. *Triporites*, spm. 1. FIG. 4. Equatorial view *Priorites*, spm. 1. FIG. 5. Equatorial view *Tricolpites*, spm. 1. FIG. 6. Equatorial view *Tetra-colporites* spm. 1. FIG. 7. Polar view *Hexacolporites*, spm. 1. FIG. 8. Equatorial view *Hexacolporites*, spm. 2. FIG. 9. Polar view *Septacolpites*, spm. 1. FIG. 10. Polar view *Octacolpites* spm. 1.

All photographs are from untouched negatives, and are magnified 680 times.

Mass., U.S.A. 3.—, *Svensk Botanisk Tidskrift*, 1947, **Bd. 41**, H. 1, pp 104-114. 4.—, *Palaeobotanist, Sakini Memorial Volume*, 1952, Institute of Palaeobotany, Lucknow, India, pp. 169-176. 5. Faegri, K., and Iversen, J., *Text Book of Modern Pollen Analysis*, 1950, Ejnar Munksgaard, Copenhagen. 6. Knox, E. M., *Trans. of Proc. of the Bot. Soc. of Edinburgh*, 1951, 35, pt. IV, pp. 437-440.

7. Krishnan, M. S., *Geology of India and Burma*, 1949, Madras Law Journal Office, Madras. 8. Rao, A. R. and Vimal, K. P., *Proc. Indian Science Congress*, Bangalore, 1951. 9. Selling, O. H., *Studies in Hawaiian Pollen Statistics*, pts. I and II, 1946-47, Bishop Museum, Honolulu, Hawaii.

INTERNATIONAL GEOPHYSICAL YEAR: 1957-58

IN 1882, scientists co-operated in studies which they called the first International Polar Year. This was concerned with the investigation of such geophysical phenomena as magnetic storms and the aurora. It was believed at that time that the aurora were a reflection of light from icebergs at the North Pole, but this was disproved when it was found that aurora did not increase in frequency as one went further north. The second Polar Year was arranged fifty years later, principally to gather data about magnetic storms. Facts ascertained at that time are still being studied.

Now it is planned in 1957-58 to change the name to the International Geophysical Year, reflecting the more comprehensive purposes of the studies, and to have about 150 ionospheric observatories ready for action. The original idea

for this Geophysical Year came from Sydney Chapman (Britain) and Lloyd V. Berkner (America). The investigation is so vast that a Central Planning Committee is being set up, with a Secretariat that will remain in being for five years afterwards to organize analysis of the data. These data are bound to be useful to the scientists working at the International Seismological Summary in Kew, England, where earthquakes are mapped; the International Isostatic Institute in Helsinki, Finland, concerned with the ever more exact determination of the changing shape of the earth; the International Latitude Service in Turin, Italy; and the Bureau de L'Heure, in Paris, France, that gives us our internationally accepted time signals.

THE GREAT KAMCHATKA EARTHQUAKE OF NOVEMBER 4, 1952

A VERY great earthquake (Sequake) shock with its epicentre now fixed by the U.S. Coast & Geodetic Survey at 52° ½ N. lat., and 159° E. long., near the East Coast of Kamchatka, with its time of origin at 16^h 58^m 20^s G.M.T., was recorded by the seismographs of the Colata Observatory on the night of the 4th-5th November 1952. The shock was of very great intensity and has been assigned magnitude 8½, same

order as the great Assam earthquake of August 1950. It was followed by 28 aftershocks upto November 16th, 1952, some of which could themselves be classified as moderate earthquakes. The main shock gave rise to a huge tidal wave which affected North Japan Islands and spread over North Pacific. No information is yet available regarding the damage in the neighbourhood.

VACUUM FUSION APPARATUS

VACUUM fusion gas analysis apparatus is finding increasingly wide use in laboratories engaged in quality control work, as well as research and development. National Research Corporation have developed the type 09-1240 vacuum fusion unit, which is convenient and versatile. It combines features which have been developed in the laboratories of National Research as well as in outstanding analytical laboratories all over the world.

A wide variety of ferrous and non-ferrous pure metals and alloys including titanium, molybdenum, stainless steels, high temperature alloys, and electronic alloys can be quantitatively analyzed for total oxygen, nitrogen and hydrogen content. Sensitivity as high as one part in ten million is possible. A high degree of accuracy and reproducibility is possible with proper operation which can easily be mastered by the analyst.

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SOME MEASUREMENTS ON THE
DIELECTRIC POLARISATION OF
ALCOHOL MIXTURES

THE dielectric polarisation of mixtures has been used as a means of detecting molecular association. In this experiment we determined the dielectric constants of normal butyl and normal amyl alcohols (C_4H_9OH and $C_5H_{11}OH$) for the pure liquids and also for their different concentrations in mixtures. The dielectric constants were measured in a gold-plated co-axial cylindrical test condenser, the coatings of which could be separated and readjusted to a high degree of precision. The test condenser was kept at a temperature of $32^\circ C$. in a thermostat. The electrical circuit consisted of two radio-frequency oscillators, one of which was a Franklin Master Oscillator. The adjustments were made by the zero beat principle, and capacities

could be measured on a wide calibrated scale to 0.1 micro-micro farad. The entire apparatus was assembled in the laboratory. Table I gives the results of the study.

TABLE I

Proportion of C_4H_9OH %	Density d (g./c.c.)	Dielectric constant ϵ	Total polarisation P_T (c.c.)
100	·7971	15.44	769.6
90	·7981	15.16	778.8
80	·7995	15.09	780.4
70	·8000	14.85	798.9
60	·8005	14.32	807.2
50	·8011	14.16	818.7
40	·8013	13.87	839.2
30	·8015	13.77	842.4
20	·8023	13.58	854.0
10	·8016	13.23	865.2
0	·8034	13.18	880.0

The last column gives the total polarisation P_T , calculated from the formula

$$P_T = \frac{\epsilon - 1}{\epsilon - 2} \cdot \frac{f_1 M_1 + f_2 M_2}{d}$$

where M_1 and M_2 are the respective molecular weights, f_1 and f_2 are the molar fractions of the two components and d is the density of the mixture.

The curve between the total polarisation and the concentration was found to be almost, though not quite, linear showing that no marked association takes place between the molecules of the two alcohols.

Our best thanks are due to Messrs. Prakash Chandra Sood and Raj Kumar Viji for help in taking the observations.

Physics Laboratories,
Panjab University College,
Hoshiarpur,
July 14, 1952.

H. R. SARNA.
P. N. TREHAN.

EFFECT OF HEAT ON THE FREQUENCY OF THE R.F. OSCILLATIONS IN A.C. 'SILENT' DISCHARGES

DIRECT experimental evidence of R.F. oscillations of discrete frequencies in an ozonizer or in a discharge tube fitted with external 'sleeve'-electrodes and excited by a suitable high voltage of 50 c.p.s. has already been reported.¹ The object of the present communication is to show the effect of thermal radiations on the frequency of the R.F. oscillations produced in hydrogen, chlorine and iodine vapour under A.C. excitation in discharge tubes fitted with external 'sleeve'-electrodes.

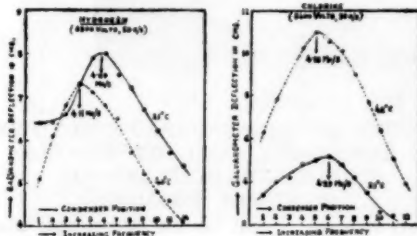


FIG. 1

The hydrogen discharge tube (pressure: 97 mm.) was excited by 6,800 volts of 50 c.p.s. The excitation voltage for the chlorine discharge tube (pressure: 30 mm.) was about 5,400 volts (50 c.p.s.), while the iodine vapour enclosed at saturation vapour pressure in the discharge tube was excited by 900 volts (50 c.p.s.). In all the cases, the resonance

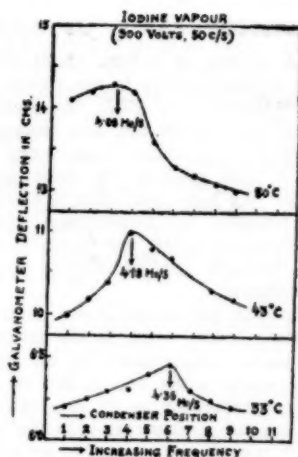


FIG. 2

maximum was found to shift towards lower frequency (or longer wavelength), as the temperature was increased. The temperature of the discharge tube was raised by exposing it to thermal radiation from a set of heater coils placed at some suitable distance. The experimental data are given in Table I.

TABLE I

Gas or vapour under 'silent' discharge	Temperature in degrees (Centigrade)	Frequency of R.F. oscillations (Mc/s)
1 Hydrogen	21	4.29
	40	4.11
2 Chlorine	21	4.29
	42	4.19
3 Iodine vapour	33	4.35
	43	4.18
	50	4.08

It should be mentioned that the frequency of the R.F. oscillation in the A.C. discharge was not found to decrease proportionately with the increase of temperature. The experimental results for hydrogen and chlorine are shown in Fig. 1, and those for iodine vapour in Fig. 2.

Detailed investigation is in progress.

Wireless Laboratory, S. R. KHASTGIR.
Physics Dept., C. M. SRIVASTAVA,
Banaras Hindu University,
August 8, 1952.

THE EMISSION BANDS OF ANILINE

THE 2,600 Å system of aniline bands has been studied by various authors in absorption. Ginsberg and Matsen¹ have given the analysis of the double-headed bands and also record a considerable number of single-headed ones. Terenin, et al.,² have studied the same bands in fluorescence. We have been able to excite these bands in emission by transformer, high frequency, condensed spark and ozoniser type of discharges through flowing aniline vapour at room temperature.

Fig. 1 shows in juxtaposition the emission and the absorption bands. (a) is the spectrogram of the emission bands excited by h.f. discharge in flowing vapour while (b) is that of absorption bands obtained in a 10 cm. cell at the saturated vapour pressure at a temperature of 30° C. Both spectra were recorded on a medium Hilger Quartz Spectrograph. It is clear from this plate that the emission bands belong to the same system as the absorption bands. In emis-

under varying conditions of vapour and its excitation, it is of interest to note that under optimum conditions for the excitation of the bands reported here, it is only the 0-0 sequence of the violet cyanogen bands that is recorded with any appreciable density.

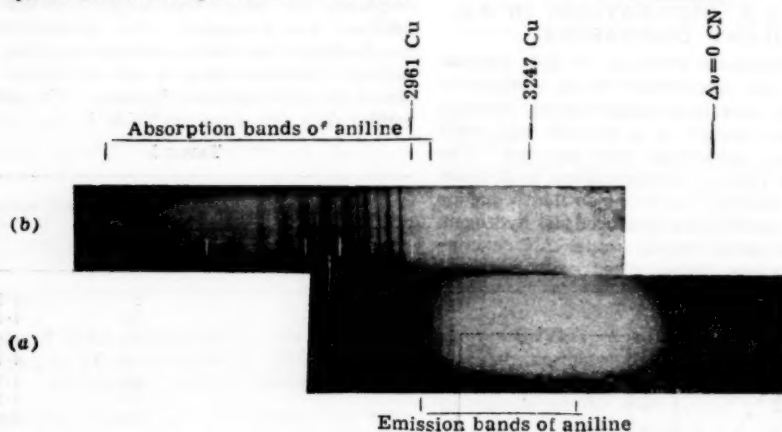
Attempts to improve the intensity of the aniline bands are in progress with a view to photograph them on instruments of higher dispersion. Details will be published elsewhere.

R. K. ASUNDI.

B. N. BHATTACHARYA (JR.)

Spectroscopy Laboratory,
Banaras Hindu University,
July 23, 1952.

1. Ginsberg and Matsen, *J. Chem. Phys.*, 1945, **13**, 167.
 2. Terenin, Vartanian and Neporent, *Trans. Faraday Soc.*, 1939, **35**, 39.
 3. Kato and Someno, *Sci. Pap. Int. Phys. Chem. Res.*, 1937, **33**, 299.
- Herzberg and Kolsch, *Zeit. Electrochem.*, 1933, **39**, 572.



sion most of the bands lie on the longer wavelength side of the 0-0 band which suffers self-absorption. The bands become more and more closely packed towards the longer wavelengths where they are overlapped by a continuum.

The diffuse bands reported by Herzberg, Kolsch, Kato and Someno³ and attributed to localized excitation in NH_2 orbitals, lying in the still shorter wavelength side of the 2,600 Å system are not recorded on our plates. It is possible that they are self absorbed but this is doubtful as the principal line of carbon (2,478 Å) lying in the same region is recorded on the plate.

While it is not the purpose of this note to deal with the dissociation products obtained

A NOTE ON MEGASPORES FROM LOWER GONDWANA COAL OF UMARIA COALFIELD, DIST. SAHDOL (VINDHYA PRADESH)

SOME samples of coal for the microscopic study were collected from the Umaria Seam of Umaria field (23° 32' : 80° 51') of the Son-Rewa-basin. The coal was macerated in pure concentrated nitric acid and it yielded a large number of megaspores along with a great bulk of microspores, woods and cuticles.

So far only a few megaspores have been reported in this country and most of the Lower Gondwana coals, e.g., Raniganj and Jharia coals do not show any megaspores. Hence their presence in Umaria coal may offer an unusual

opportunity for obtaining definite information of the plant population contributing to this particular field. Variation of the initial plant constituents is one of the important causes for the origination of different types of coal. Type classification is fundamental in the differentiation of coals, but unfortunately its achievement has been delayed because of imperfect knowledge of the plant components. Shitholey¹ studied a megaspore cast from the Triassic of Saki Range, one megaspore has been recorded from the Upper Tertiary of Assam² and Trivedi³ has recorded some megaspores from the Lower Gondwana rocks of Singrauli coalfield, Mirzapur District. Besides these, the author has not come across any other published record of megaspores from India.

The megaspores (Figs. 1 and 2) are radially symmetrical showing definite proximal and distal aspects according to relationship established in the original spore tetrads. The proximal side is marked by triradiate sutures "radiating equally or nearly so from the centre of elaborate equivalent structures arising at the extreme margin of contact between sister spores of the original tetrads". The distal surfaces are smooth and variously ornamented. Ornamentation is generally less well developed on the proximal than on the distal surfaces. Megaspores vary greatly in size from 250 μ to 1 mm. in diameter (some increase is of course due to their flattening). Most of them are very well preserved and exhibit triradiate mark and ornamentation very clearly.

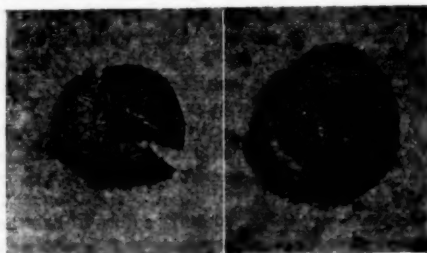


FIG. 1. Meg spore with triradiate sutures, $\times 25$.

FIG. 2. Megaspore showing 'central body' presumably shrunken endspore, $\times 25$.

In Fig. 1 the megaspore measured from one radial extremity to the opposite margin ranges from 260 μ to 320 μ . Body diameter is slightly less than 0.5 mm. The body is round to slightly oval or cuneiform. A triangular appearance is imparted by the triradiate apparatus thickening in these areas. However, the triangular appear-

ance is frequently more apparent than real. The body is brown in colour in reflected light. The whole body of the megaspores is reticulately to matte textured. In some megaspores as in Fig. 2 dark 'central body' is seen which "is considered to be a shrunken endospore membrane which in modern spores is connected with the outer layer of spore coat near the apex. Its presence as a shrunken sac may indicate that the gametophyte in these cases was abortive when the spores were deposited, otherwise the endospore probably would have been distended against the mesospores and exospore."⁴

The present discovery of megaspores in great abundance is therefore of interest. It affords evidence of the existence of Lycopods in the Palaeozoic of India⁵ whose presence is otherwise unknown. These megaspores show an affinity with the free sporing Lycopods of Triletes species chiefly *T. triangulatus zerndt. var. zonatus* (Ibrahim).^{4,5}

Fuel Res. Inst.,
Jeolgora,
August 20, 1952.

B. TRIPATHI.

1. Shitholey, R. V., *Proc. Nat. Acad. Sci. Ind.* 1943, 13.
2. —, *Jour. Ind. Bot. Soc.*, 1947, 23. 3. Trivedi, B. S., *Current Science*, No. 9, April 1930. 4. Schopf, J. M., *Report of Investigation*, No. 53 of Illinois State, 1939, p. 32, 37*. 5. — Wilson and Bental, *Ibid.*, No. 91, Illinois State, 1944.

* F spores from the Herrin (No. 6) Coal Bed in Illinois.

ELECTRODEPOSITION OF CADMIUM-ZINC ALLOYS FROM THE SULPHAMATE-BATH

CADMIUM-ZINC alloy deposition finds application in the protective finishing of metals. An alloy containing 40 to 60% zinc affords very good protection to mild steel. It is usually deposited from cyanide solutions, though acid sulphate solutions have also been studied.^{1,2}

The electrodeposition of cadmium from the sulphamate-bath has been reported by Mathur and Rama Char,^{3,4} Piontelli^{5,6} and Choguill,⁷ and of zinc by the latter authors.^{5,6,7} Experiments conducted in this laboratory have shown that extremely adherent, light grey, dense and fairly well distributed zinc deposits can be obtained on steel from N, 2N and 3N zinc sulphamate solutions at 25°C. in the c.d. range 1.6-8.1 amp./dm.² with cathode efficiencies over 97% using zinc anodes. Measurements of the cathode potentials of cadmium and zinc and of alloy deposition potentials⁸ in sulphamate

solutions indicated the possibility of co-depositing the two metals from these solutions. In this investigation the work on co-deposition has been restricted to the study of the influence of the common variables in alloy deposition. The only previous work on cadmium-zinc deposition from the sulphamate-bath is that of Piontelli and Canonica⁹ who have not given details of their experimental results but stated that the deposits were in general not very promising, being spongy, irregular and variable as regards crystalline grain and appearance.

The plating-bath contains zinc sulphamate, cadmium sulphamate and free sulphamic acid to adjust the pH. The co-deposition has been studied in detail, using steel cathodes and cadmium anodes. The effect of c.d. on alloy deposit composition is shown in Table I.

TABLE I

Bath Composition: 65 gm./L zinc, 13 gm./L cadmium, 220 gm./L total sulphamate (as sulphamic acid) pH = 2, Temp. = 25° C.
Vigorous stirring

Cathode c.d. amp./dm. ²	Composition of deposit	
	Cadmium %	Zinc %
0.97	94	6
1.93	88	32
2.90	44	56
3.39	18	82
3.87	8	92

The cadmium content in the alloy deposit decreases as the c.d. is increased. At constant c.d., the cadmium content increases by increasing the temperature, pH, or cadmium content of the electrolyte and by agitation. The deposit composition depends only on the ratio of cadmium to zinc in the electrolyte and is unaffected by the total metal content if this ratio is maintained constant.

Deposits analysing 8 to 98% cadmium (92 to 2% zinc), can be obtained by varying the operating conditions. They are, however, of poor quality, darkening in colour as the zinc content increases and generally of a coarse crystalline nature. The addition of a 0.1 gm./L each of glue, thiourea and dextrin effects slight improvement. The throwing power of the plating solution is fairly good.

Our thanks are due to Prof. K. R. Krishnaswami, for giving facilities and taking interest in the work.

Electro-Chemistry Lab., J. MATHUR.
Dept. of General Chem., T. L. RAMA CHAR.
Indian Inst. of Science,
Bangalore-3,
August 30, 1952.

1. Fink and Young, *Trans. Electrochem. Soc.*, 1935, **67**, 311.
2. Parks and LeBaron, *Ibid.*, 1936, **70**, 373.
3. Mathur and Rama Char, *Proc. 36th Indian Science Congress*, Part III, 1952, 237.
- 4.— *J. Sci. Ind. Res.*, India, (Under publication).
5. Piontelli and Guilto, *Chem. Abs.*, 1940, **34**, 677.
6. Piontelli, *Ibid.*, 1944, **38**, 2571.
7. Choguill, *Ibid.*, 1940, **34**, 5351.
8. Parks and LeBaron, *Trans. Electrochem. Soc.*, 1936, **69**, 509.
9. Piontelli and Canonica, *Proc. 3rd Internat. Electrodep. Conference*, E.T.S., 1948, 121.

ELECTRODEPOSITION OF TIN FROM THE PYROPHOSPHATE-BATH

TIN is commercially electrodeposited from the acid sulphate and alkaline stannate solutions. The acid-bath has some advantages over the alkaline-bath in respect of current efficiency, plating speed and bath voltage, but its throwing power is poor. The bath composition and the anodic reaction has, however, to be carefully controlled in both cases, as otherwise there is a tendency for the precipitation of insoluble salts and the formation of faulty deposits.

The present investigation is concerned with the electrodeposition of tin from a new type of bath, namely, the pyrophosphate-bath, prepared by adding sodium pyrophosphate to stannous pyrophosphate, a complex being formed. The only mention of the use of this bath for electrodeposition appears to be the very old Roseleur solution of 1850,^{1,2} consisting of stannous chloride and sodium pyrophosphate.

A detailed study has been made of the effect of concentration of tin and pyrophosphate, current density, temperature, agitation, pH and addition agents on the electrodeposition. The conductivity of the plating solution has been measured as also the cathode and anode polarization under varying conditions. The bath gives smooth, white, bright, adherent and readily polishable deposits of good quality. It can be worked satisfactorily over a wide range of experimental conditions. The cathode and anode efficiencies are very nearly 100% and anode corrosion is good. Increase in the concentration of metal increases the c.d. range. Increasing the ratio of total pyrophosphate to metal increases the conductivity and to a small extent the c.d.

It is not advisable to go beyond the ratio 5:1, as an excess of pyrophosphate tends to crystallize the bath, especially when the temperature falls.

Increase of temperature or bath agitation raises the limiting c.d. Small variations in pH are of little significance but above pH 10.5, dark, spongy deposits are obtained. Although the bath is satisfactory by itself, several addition agents have been tried with a view to effect an improvement in its performance. The best results are obtained with a combination of gelatin and dextrin. They increase the limiting c.d. and the brightness of the deposit.

The optimum conditions are: tin (stannous): 22-33 gm./L, total pyrophosphate: 112-68 gm./L, gelatin: 1 gm./L, dextrin: 10 gm./L, cathode: steel or copper, anode: tin, temp.: 60-80° C., pH: 8.0-9.5, c.d.: 1.1-4.4 amp./dm.², stirring, voltage: 0.4-0.8 volts, time required for plating 0.001" at 2.2 amp./dm.²: 25 minutes.

The tin pyrophosphate-bath compares well with the sulphate-bath in c.d. range, current efficiency, quality of plate, plating speed, cost of plating solution, bath voltage and ease of control and maintenance. The deposits are bright and the throwing power of the solution is quite good. In view of these considerations, this bath appears to be suitable for the electrodeposition of tin.

Our thanks are due to Prof. K. R. Krishnaswami, for giving facilities and taking interest in the work.

Electro-Chemistry Lab., J. VAID.
Dept. of General Chem., T. L. RAMA CHAR.
Indian Inst. of Science,
Bangalore-3,
August 30, 1952.

1. Kern, *Trans. Electrochem. Soc.* 1913, **23**, 193. 2. Oplinger and Bauch, *Ibid.*, 1941, **80**, 617.

IRON CONTENT OF INDIAN COMMERCIAL SUGARS AND ITS INFLUENCE ON THE CITRIC ACID PRODUCTION BY *ASPERGILLUS* *NIGER*

WITH a view to finding out the suitability of commercial sugars available in the country for use in citric acid production by *Aspergillus niger*, forty-seven samples of cane sugar produced by different factories in India were analysed for iron, colorimetrically, using α - α -dipyridyl. Results are given in Table I.

TABLE I

Iron content 10 ⁻⁵ g. per 100 g.	Number of samples analysed	Colour of samples
10-15	12	White
15-20	10	Pale grey
20-25	13	
25-30	4	
30-35	8	
50-80	2	Grey

In conformity with the known influence^{1,2} of iron and other heavy metals present in cane sugar on the production of citric acid from this sugar, we have found a good correlation between the iron content and citric acid yield as given in Table II. A citric acid producing strain of *Aspergillus niger*, (NRRL 67) was used in these experiments.

TABLE II

Sugar* sample	Iron content 10 ⁻⁵ g per 100g	Per cent. sugar meta- bolised	Conversion per cent.
1 A. R. Sucrose	Nil	98.2	52.1
2 2 (M)	26	87.5	45.1
3 11 (a)	10	91.8	54.1
4 11 (b)	12	92.2	53.0

* (M), (a) and (b) refer to different sources of commercial sugar.

Whiter varieties of commercial sugars containing less iron than the greyer varieties are therefore more suitable for citric acid production. Removal of the suspended impurities in the sugar solutions is desirable as a general rule, since, like unsprouted spores,³ they may have a toxic effect towards citric acid production.

The authors' thanks are due to Dr. V. Subrahmanyam, Director of this Institute, for his keen interest and valuable suggestions.

Central Food Technological Y. S. LEWIS.
Research Institute, D. S. JOHAR.
Mysore,
August 8, 1952.

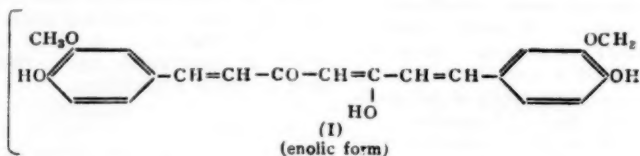
1. Perlman, et al., *Arch. Biochemistry*, 1946, **11**, 131.
2. Shu and Johnson, *Ind. Eng. Chem.*, 1948, **40**, 1202.
3. Doelger and Prescott, *Ibid.*, 1934, **26**, 1142.

THE COLORING MATTER IN TURMERIC

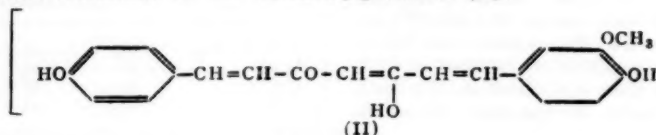
WHEN an attempt was made to estimate curcumin in turmeric using a solution of boric acid and oxalic acid in glacial acetic acid as the color forming reagent and crystalline curcumin as a

reference standard, it was found that the color obtained with turmeric extract was slightly different from that obtained with pure curcumin. With turmeric extracts, the solution exhibited a pronounced orange fluorescence which was absent in the reference solution. This pointed to the possible presence of another substance, or substances besides curcumin, in turmeric, which was responsible for this fluorescence. A careful search of the literature showed that no information on this point also was available.

1. Curcumin whose structure was determined (DFM) (I).

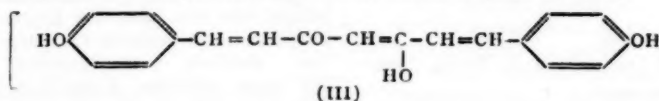


2. The second constituent of the turmeric pigments is (II).



Hydroxy-cinnamoyl-feruloyl-methane (HCFM).

3. The third fraction is Dihydroxy-dicinnamoyl-methane (DDCM) (III).



It was therefore decided to carry out a chromatographic analysis of the pigments in turmeric. Extracts of powdered turmeric in benzene were passed through a column of silica gel. Development of the chromatogram with benzene showed three distinct zones and a few minor ones. These were isolated as liquid chromatogram in separate receivers. On concentrating the solutions by evaporation under reduced pressure, the substances were thrown out of solution; the crystals were filtered, washed with benzene, dried and recrystallised from ethanol. The fraction first to leave the column was the major constituent, and consists of curcumin, obtained as orange yellow prisms melting at 183° C. The second fraction was an amorphous yellow powder melting at 168° C. while the third crystallised out in yellow plates melting at 224° C. This fraction produces with boric-oxalic acid reagent a pink color with a brilliant orange fluorescence,

The molecular weights, methoxyl values, chemical reactions, absorption spectra, etc., showed that the three substances are related to each other. Thus while curcumin has 2 methoxy groups in its molecule, the second fraction has only one and the third has none.

The structure of these three substances could be represented as follows.

Besides these major constituents, three minor fractions were also isolated. Their reactions and properties indicate that they are the geometrical isomerides of the three major constituents mentioned by Kostanecki, *et al.*,¹ is diferuloyl methane

tioned above. The detailed account is being published elsewhere.

King Institute,
Guindy, Madras 15,
August 8, 1952.

K. R. SRINIVASAN.

1. Milobedska, Kostanecki, and Lampe, *Ber.* 1910, 43, 2163.

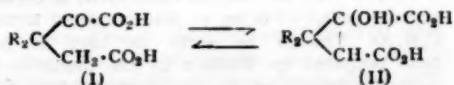
FORMATION AND REACTION OF $\beta\beta$ -DISUBSTITUTED α -KETO-GLUTARIC ACIDS

A GENERAL method¹ for the synthesis of α -keto-glutaric acids consists in treating $\alpha\alpha'$ -dibromoglutaric acids with aqueous or alcoholic potash followed by hydrolysis of the intermediate hydroxy-, or alkoxy-cyclopropane acids first formed. According to the alternative method of Bardhan² $\alpha\alpha$ -di-substituted succinic acids are converted according to known method through

TABLE I

Compound	M.P. or B.P.	Analysis		Molecular weight by titration
		C	H	
Methylhydrogen- α -diethyl succinic acid	.. m.p. 46-47°	57.2 (57.4)	8.1 (8.4)	188.8 (183)
Methyl β -diethyl-levulate	.. b.p. 120°/10 mm.	64.6 (64.5)	9.8 (9.7)	
Semicarbazone	.. m.p. 115-16°	54.2 (54.3)	8.7 (8.6)	
β -Diethyl levulic acid*	.. " 114°	62.6 (62.8)	9.5 (9.3)	72.2 (72)
Semicarbazone	.. " 108-69°	52.4 (52.6)	8.5 (8.3)	
Methyl β -diethyl- β -benzoylpropionate	.. b.p. 181-83°/8 mm.	72.2 (72.6)	8.2 (8.1)	
β -Diethyl β -benzoylpropionic acid*	.. m.p. 92°	71.8 (71.9)	7.5 (7.7)	
Semicarbazone	.. " 129-30°	61.7 (61.8)	7.0 (7.2)	
γ -phenyl β -diethyl butyric acid	.. " 53-54°	76.1 (76.4)	9.2 (9.1)	220.8 (220)
α -Keto- β -diethyl-glutaric acid**	.. " 127-28°	53.3 (53.5)	6.8 (6.0)	202 (202)
Quinoxaline derivative	.. " 201-02°	65.8 (65.7)	6.3 (6.6)	
Semicarbazone	.. " 180-81°			
β -Diethyl glutaric acid ⁵ (Clemmensen)	.. " 108°			
α -Dipropyl succinic acid	.. " 84°	59.4 (59.4)	8.9 (8.9)	202.6 (202)
Anhydride	.. b.p. 141-62°/24 mm.	65.3 (65.2)	8.9 (8.7)	
Methyl β -dipropyl levulate	.. " 106°/6 mm.	67.4 (67.3)	10.1 (10.3)	
Semicarbazone	.. m.p. 163°	57.4 (57.5)	9.5 (9.4)	
β -Dipropyl levulic acid semicarbazone	.. " 193°	56.3 (56.0)	8.9 (8.9)	
Methyl β -dipropyl- β -benzoylpropionate	.. b.p. 171°/5 mm.	73.9 (73.9)	8.8 (8.7)	
β -Benzoyl- β -dipropyl propionic acid*	.. m.p. 101-02°	73.3 (73.3)	8.4 (8.4)	232.2 (232)
β -Dipropyl γ -phenyl butyric acid (Clemmensen)	.. " 153-54°	77.5 (77.4)	9.9 (9.7)	244.2 (248)
α -Keto β -dipropyl-glutaric acid**	.. " 101-03°	66.7 (66.7)	9.6 (9.6)	198.4 (198)
Semicarbazone	.. " 185-80°			
Quinoxaline-derivative	.. " 248°	67.3 (67.5)	7.0 (7.3)	
β -Dipropyl glutaric acid ⁷ (Clemmensen)	.. " 113-14°			
Methyl <i>trans</i> - β -decalin-2-acetyl-2-acetate	.. b.p. 185°/5 mm.	71.5 (71.4)	9.4 (9.5)	
<i>trans</i> - β -Decalin-2-acetyl-2-acetic acid*	.. m.p. 118-19°	70.6 (70.6)	9.3 (9.2)	238.6 (238)
Methyl <i>trans</i> - β -decalin-2-benzoyl-2-acetate	.. b.p. 210°/4 mm.	76.5 (76.4)	8.3 (8.3)	
<i>trans</i> - β -Decalin-2-benzoyl-2-acetic acid	.. m.p. 157-58°	75.9 (76.0)	8.2 (8.0)	300 (300)
(Clemmensen)	.. " 178°	70.7 (70.7)	9.2 (9.1)	286.8 (286)
α -Keto <i>trans</i> - β -decalin-2 : 2-diacetic acid**	.. " 156°	62.6 (62.7)	7.6 (7.6)	238.2 (238)
Quinoxaline derivative	.. " 230°			
<i>trans</i> -Decalin-2 : 2-diacetic acid (Clemmensen) " 175°			

the half-ester chloride into the corresponding levulic acids which on oxidation with alkaline potassium permanganate afford the corresponding α -keto-glutaric acids in good yield. A number of these acids have now been prepared according to this method and their action on hot concentrated aqueous alkali has been examined. The important fact emerges that all the keto-glutaric acids examined in this connection can be recovered unchanged and the supposed existence³ of keto-cyclol tautomerism between the keto acid (I) and the hydroxy-cyclopropane acid (II) when R = ethyl or n-propyl cannot be substantiated.



The compounds in Table I were prepared by this method. Those marked with an asterisk showed no change on reaction with hot aqueous

alkali. Quantities within brackets are those expected from molecular formula.

I wish to thank Prof. J. C. Bardhan for his interest in the progress of this work.

Organic Chemistry Lab., K. C. BHATTACHARYYA,
University College of Science,
Calcutta-9,
August 11, 1952.

1. Perkin and Thorpe, *J.*, 1901, 79, 737. 2. Bardhan, *J.*, 1928, 26/4; also Khuda and Bhattacharyya, *J. Ind. Chem. Soc.*, 1947, 15. 3. Deshpande and Thorpe, *J.*, 1922, 121, 1430; Bains and Thorpe, *Ibid.*, 1923, 1209; Baker, *Tautomerism*, p. 176. 4. Deshpande and Thorpe, *loc. cit.*, p. 1430. 5. Guareschi, *Atti Accad. Sci. Torino*, 1900-01, 34 443; Vogel, *J.*, 1934, 1761. 6. Bains and Thorpe, *J.*, 1923, 1208. 7. Guareschi, *Gazzetta*, 1919, 49, 1, 124; also Bains and Thorpe, *loc. cit.*, p. 1209. 8. Rao *J.*, 1930, 1162.

ORIENTATION IN THE THIAZOLE NUCLEUS

In the course of our studies on the orientation in the thiazole nucleus, we have brominated and nitrated a number of thiazole derivatives. In view of the recent publication by Prijs, Mengisen, Fallab and Erlenmeyer,¹ we record below our findings.

2-Methylthiazole, on bromination (at 100° C.) furnishes 2-methyl-5-bromothiazole, and on nitration (at 100° C. for 10 hours and at 120° C. for 4 hours), yields 2-methyl-5-nitrothiazole (m.p. 120-21° C.). 4-Methylthiazole could not be brominated; on nitration it gives a nitro compound, m.p. 58-59° C. shown to be 4-methyl-5-nitrothiazole.² 5-Methylthiazole on bromination yields a bromo compound which, heated with sulphanilamide, potassium carbonate and copper powder, furnishes 2-sulphanilamido-5-methylthiazole; hence the bromo compound should be 2-bromo-5-methylthiazole. On nitration, 5-methyl-thiazole furnishes a nitro compound, m.p. 110° C., which, not being identical with 2-nitro-5-methylthiazole, m.p. 61° C.,² should be 5-methyl-4-nitrothiazole.

2-Hydroxythiazole (m.p. 69-70° C.) prepared by the action of chloroacetaldehyde on ammonium thiocarbamate, on bromination furnished 2-hydroxy-5-bromothiazole (m.p. 67° C. decomp.), on nitration 2-hydroxy-5-nitrothiazole (m.p. 146-47° C.), and on treatment with acetic anhydride, 2-hydroxy-5-acetylthiazole (m.p. 195-97° C.).

5-Acetaminothiazole on bromination, even with one molecular equivalent of bromine, yielded only the dibromo derivative, 2:4-dibromo-5-acetaminothiazole, m.p. 148-49° C., as reported by Prijs, *et al.*;¹ the mono-bromo derivative could not be obtained. When 5-acetaminothiazole-2-carboxylic acid (I) was brominated, instead of the 4-bromo derivative of this acid, only 2:4-dibromo-5-acetaminothiazole could be isolated.

Nitration of 5-acetaminothiazole furnished a product, m.p. 197-98° C., which Prijs, *et al.*¹ consider to be 2:4-dinitro-5-acetaminothiazole, but we find this compound to be only the mono-nitro compound, 4-nitro-5-acetaminothiazole, not only from the analytical figures but also because 5-acetaminothiazole-2-carboxylic acid on nitration furnished 5-acetamino-4-nitrothiazole-2-carboxylic acid, m.p. 155-56° C., which on decarboxylation yielded 5-acetamino-4-nitrothiazole, m.p. 197-98° C. identical with the product obtained above. Fuller details will be published elsewhere shortly.

Dept. of Chemotherapy, K. GANAPATHI.
Haffkine Institute, Parel, K. D. KULKARNI.
Bombay-12,
September 9, 1952.

1. Prijs, Mengisen, Fallab and Erlenmeyer, *Helv. Chim. Acta.*, 1952, **35**, 187. 2. —, Ostertag and Erlenmeyer, *Ibid.*, 1947, **30**, 1200.

SYNTHESIS OF 5-ETHYL AZULENE

β -ACETYL INDANE was prepared¹ by the Friedel-Craft's reaction on indane. Reduction of β -acetyl indane by the modified Clemmensen method² using alcohol as miscible solvent gave 5-ethyl indane, b.p. 114-16°/24 mm., n_D^{20} 1.5262.



— 5-ethyl azulene

(Found C, 88.5%; H, 11.7%; $C_{11}H_{14}$ requires C, 90.4%; H, 9.6%). By reaction with ethyl diazoacetate according to the method of Pfau and Plattner,³ 5-ethyl indane was converted to an ester, b.p. 145-50°/2 mm. On hydrolysis the ester yielded an acid, b.p. 167-70°/3 mm. which on heating with palladised charcoal (10%) gave a blue distillate from which 5-ethyl azulene (I) has been isolated. It formed a T.N.B. complex which after repeated crystallisations showed a m.p. of 97-97.5°. (Found: C, 59.0; H, 4.3; N, 11.9. $C_{15}H_{15}N_3O_6$ requires C, 58.5; H, 4.7; N, 11.4%.)

Fuller details of the work will be published elsewhere.

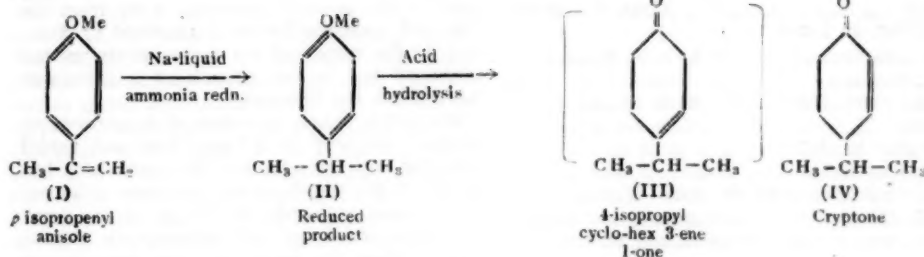
The authors' thanks are due to Dr. B. H. Iyer for his kind interest in this investigation.

Organic Chemistry Dept., A. SOMASEKAR RAO.
Indian Inst. of Science, M. S. MUTHANNA.
Bangalore,
September 24, 1952.

1 Julius V. Braun, Georg Kirschbaum and Hans Schuman, *Ber.*, 1920, **53B**, 1163. 2. Fieser and Seligman, *J. Am. Chem. Soc.*, 1936, **58**, 2482. 3. Alexander St. Pfau and Plattner, *Helv.*, 1939, **22**, 207.

SYNTHESIS OF CRYPTONE

CRYPTONE (IV), an unusual constituent of certain essential oils,^{1,2,3} is an α : β -unsaturated ketone $C_{15}H_{14}O$. Though as early as 1905 it had been prepared by Wallach by the oxidation of β -phellandrene⁴ or by the isomerisation^{5,6} of terpene-degradation-products like no-pinone and sabina-ketone, no direct synthesis of this



interesting ketone appears to have been attempted upto the present day. As cryptone is very important from the point of biogenesis of essential oil-constituents, and also for building up terpene-molecules like α -phellandrene, it was thought of interest to synthesise it according to the following scheme:

The reduction of *p*-isopropenyl anisole (I) by sodium and liquid ammonia furnished a liquid (b.p. 58-9°/2 mm., yield 48%) and a solid (m.p., 188°, yield 13%).

The liquid product, on hydrolysis with 10% sulphuric acid followed by treatment with an alcoholic solution of semi-carbazide acetate, gave a semi-carbazone which after three recrystallisations from dilute alcohol was obtained as colourless prismatic crystals, m.p. 183-85° (Found: N, 21.93. $C_{10}H_{17}N_3O$ requires N, 22.01 per cent.), m.p. of *dl*-cryptone-semicarbazone is 183-84° (Wallach, *loc. cit.*). The overall yield of the ketone on the basis of the semi-carbazone was about 15 per cent.

The solid appears to be a dimeric compound $C_{20}H_{24}O_2$ [Found: M.W. (by Rast's method), 300.8; C, 81.15; H, 9.14. $C_{20}H_{24}O_2$ requires M.W., 296; C, 81.08 and H, 8.1 per cent.]. On reduction (Adam's catalyst in glacial acetic acid) it absorbed six moles of hydrogen and furnished a reduced product, m.p. 182°. On nitration it gave a tetra-nitro-compound, m.p., 239-40° (Found: N, 11.95. $C_{20}H_{24}N_4O_{10}$ requires N, 11.72 per cent.).

Further work is in progress.

The author thanks Dr. B. H. Iyer and Dr. Sukh Dev for their keen interest in the work.

Dept. of Organic Chemistry, A. BHATI.
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September 24, 1952.

EXAMINATION OF THE ROOT BARK OF *TABERNAEMONTANA CRISPA* (DICHOTOMA)

VERY little work seems to be on record on the genus *Tabernaemontana* (Apocynaceae). Greshoff¹ and Ultee² have recorded that the milky juice of *T. Spærocarpa*, a species from Java, contained resins, amyris acetate and proteins, while the bark contained 0.5% of an unidentified alkaloid. From *T. coronaria* Br. Ratnagiriswaran and Venkatachalam³ have isolated two alkaloids, tabernaemontanine, $C_{20}H_{20}O_3N_2$, m.p. 208-10°, and coronarine, $C_{44}H_{56}O_6N_4$, 2.5 H_2O , m.p. 196-98° (dec.).

The present report records the results of a preliminary investigation on the chemical constituents of *T. crispa* root bark. The root bark showed the presence of alkaloids and neutral bodies. It has not yet been possible to get the alkaloid in an analytically pure condition.

400 grams of the dried and powdered root bark was exhausted with alcohol. Appreciable quantities of a neutral product separated on cooling and this was removed by filtration. Concentration and chilling gave further quantities of the same product, the total amounting to about 8% on the weight of the bark.

The filtrate was freed from alcohol, treated with water and made acidic to congo red with dilute hydrochloric acid. The resinous insoluble matter was taken up in chloroform and the aqueous layer basified with ammonia. After chilling the yellow precipitate was taken up in chloroform, the extract dried and the solvent removed at a low temperature. The resulting viscous resin solidified to a brittle mass on keeping in a vacuum desiccator, melting at 85°. Yield 12-14 grams, about 3.5% on the weight of the dried root bark.

The neutral material gave a fraction melting at 192-94° on repeated crystallisation from alcohol. It is not affected by bromine in carbon tetrachloride, cold acetone-permanganate and boiling acetic anhydride. It gave negative tests

1. Cahn, Penfold and Simonsen, *J.C.S.*, 1931, 1366.
2. Berry, Macbeth and Swanson, *Ibid.*, 1937, 1446.
3. Wienhaus and Striegler, *Schimmel and Co. Reports*, 1937, 91.
4. Wallach, *Annalen*, 1905, 343, 3.
5. —, *Ibid.*, 1907, 356, 235.
6. —, *Ibid.*, 1908, 359, 270.

with carbonyl reagents. It analyses for the formula $C_{12}H_{20}O$ (Found C: 79.84, H: 11.01; Calculated: 80.0 and 11.1).

Maharaja's College, A. R. S. KARTHA.
Ernakulam and
Madras Univ. Laboratory, K. N. MENON.
Guindy,
September 26, 1952.

1. Greshoff, *Ber.*, 1890, 23, 3545. 2. Ultee, *Chem. Weekbl.*, 1916, 13, 183. 3. Ratnagiriswaran and Venkatachalam. *Quart. J. Phar. Pharmacol.*, 1939, 12, 174.

ON THE OCCURRENCE OF CRANGONIDS (CRUSTACEA, CARIDEA) IN THE COASTAL WATERS OF TRIVANDRUM

THE Crangonids are bottom-dwelling Crustaceans, generally found among sea-weeds in deep waters. Only two species, viz., *Pontophilus hendersoni* Kemp and *P. parvirostris* Kemp have been collected from the Trivandrum Coast at a depth of 15 faths. from a sea bottom formed of mud and shell fragments. The first form is represented by seven specimens including ovigerous females and immature specimens while only a single specimen of the second species has been obtained.

Specimens of *P. hendersoni* collected differ from those recorded by Kemp^{1,2} in the following points: (1) The distal lobe of the antennal scale is less acute and its extremity stands below the apex of the spine on its outer margin. (2) The thumb of the sub-chela in the first peraeopod is narrower and is about double the length across its base. (3) The fingers of the second peraeopod are more than double the length of the palm and their apices are not 'constricted'; a very small tubercle is noticeable at its extremity under high power. (4) The tubercle on the dorsum of the third abdominal somite is visible only as a wavy projection. (5) The specimens from Trivandrum are comparatively large, the ovigerous females measuring 22.5-23 mm., while the largest specimen from the Chilka Lake is only 12 mm. long. (6) Marked difference in colour is also noticed: In the Travancore specimens there are numerous small brown spots and a 'V'-shaped dorsal median mark on the carapace formed by the aggregation of brown pigment spots; the ventral side of the body is whitish.

The affinity of *Pontophilus* Leach and *Philocheras* Stebbing has been discussed by Kemp^{1,3} who suggested that *Philocheras megalochir*

Stebbing⁴ is closely related to *P. hendersoni* Kemp. The present specimens differ from the type and approach the form described by Stebbing in the nature of the apices of the second peraeopod and in the absence of a prominent tubercle on the abdomen.

The single female specimen of *P. parvirostris* Kemp^{2,5} obtained is 8.5 mm. long and agrees with the type except that the rostrum is less produced, the thumb of the sub-chela is longer, being about a quarter the length of the hand, the sixth somite of the abdomen is slightly smaller than the telson and the dorso-lateral spinules on the telson are indistinct.

Both *P. hendersoni* and *P. parvirostris* were previously recorded from the East Coast of India, the former one being obtained from Chilka Lake and Orissa Coast from shallow water up to 4½ faths., while the latter was collected from Kilkarai and Waltair. The present record extends the distribution of the species to the West Coast of India also.

The author is grateful to Dr. N. K. Panikkar for his valuable suggestions.

Fisheries Research Station, C. V. KURIAN.
University of Travancore,
Kayamkulam,
August 20, 1952.

1. Kemp, *Mem. Ind. Mus.*, 1915, 5, 201-64, pl. 8, fig. 8, t.-fig. 25. 2. —, *Rec. Ind. Mus.*, 1916, 12, 372-74, pl. 8, fig. 6. 3. —, *Ibid.*, 1911, 6, 5-12. 4. Stebbing, *Ann. S. Afr. Mus.*, 1914, 15, 71-72. 5. Kemp, *Rec. Ind. Mus.*, 1925, 26, 341.

A NEW SPECIES OF SYNASCIDIAN FROM MADRAS

In a former paper³ the anatomy and larval organisation of a synascidian belonging to the genus *Polyclinum* were described in detail by the author. The outstanding character of this species is the presence of 12 ectodermal ampullae as a ring surrounding the anterior tip of the larva. According to Berrill¹ there are only 8 ampullae in *Archidistoma*, *Polyclinum* and *Poly-syncrator*, and 4 in other didemnids and polyclinid species. In the present form, the 12 ampullae are arranged in three rows of four each, one median and two lateral rows. Other ampullae such as those sometimes found on the outer margin of the lateral rows, or the posteriorly directed vesicles with long narrow tubular 'stalks' and pinnately arranged branches may prove to be of diagnostic value. But, as Van Name⁴ states "the true *Polyclinum* are all very closely related to each other, their zooids

apparently having nearly the same structure so that we must depend chiefly on the gross characters of the colony for distinguishing them". The present form is a rectangular and fleshy colony without encrustation of sand, and attached to the substratum by one of the flat surfaces. *P. constellatum* Savigny, described by Herdman² as occurring in the Indian Ocean, is very near to the present form in the nature of the ascidiozoid, but differs in certain of its characteristics, viz., an ovate or pyriform colony when young, and umbrella-shaped when fully grown, the area of its attachment being small; and also differs from the present species in the number and rows of stigmata. Whereas *P. constellatum* has the branchial sac with 14 to 18 rows of stigmata, each row with from 18 to 22 stigmata, the present form has a branchial sac with 13 rows of stigmata, each row having 13 stigmata.

In view of these differences this may be treated as a new species, *P. madrasensis*, which may be defined as follows:

Shape of Colony: Rectangular and fleshy, attached to the substratum by one of the flat surfaces. **Test:** Soft and gelatinous, with a faint white colour. No encrustation of sand. **Ascidiozoid:** Size from about 5 to 11 mm., arranged in systems. Branchial opening six-lobed, atrial opening smooth. Atrial languet present. **Tentacles:** 30 to 40, of roughly 3 dimensions. **Branchial sac:** Well developed, with 13 rows of stigmata, each row having 13 elliptical stigmata. **Dorsal lamina:** A series of languets. **Abdomen:** U-shaped with unequal limbs, the length below the branchial region being about $\frac{1}{4}$ the length of branchial sac. **Post-abdomen:** Long and pedunculated, containing gonads and terminal heart. **Larva:** 12 anterior ampullae arranged in three rows. Posteriorly directed bunches of vesicles present.

University Zoology V. O. SEBASTIAN.

Research Laboratory,
Chepauk, Madras,
September 17, 1952.

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OCCURRENCE OF THE GREEN MUSCARDINE FUNGUS ON PYRILLA SP. IN BOMBAY

THE natural occurrence of an entomogenous fungus on leaf hoppers (*Pyrilla* sp.) in the

sugarcane fields on the Deccan Canals in Bombay State evoked considerable interest. Large numbers of nymphs and adults were found to be parasitised by the fungus, thereby indicating the potentialities of the pathogen. The fungus was isolated in pure culture to carry out inoculation studies and establish its identity.

The fungus made very poor growth on potato dextrose agar and other solid media, but made scanty growth with sparse sporulation on a medium containing beef extract. However, when grown on sterilized rice, or rice mixed with an equal part of peanut hulls and incubated at temperatures between 20-24° C. the growth was fairly rapid. The mycelium formed a dense whitish growth on which olive green to olive black spore masses were produced after 10 to 12 days.

Microscopic examination revealed that the fungus was identical with *Metarrhizium anisopliae* (Meisch.) Sorokin. Butler and Bisby¹ record this fungus as having been collected by Rhind in Burma on *Oryctes rhinoceros*. The hyphae are whitish, septate. The conidiophores are penicillately branched and produce conidia in chains. The conidial masses are dry and the columns of conidia are persistent. There is variation in the size of the conidia as indicated by Pope.³ The spores obtained from colonies on nutrient agar measured $5.7.5 \times 2.3-3.5 \mu$, while those from colonies on sterilized rice were $8-14 \times 3.4-5 \mu$.

Detailed accounts of this fungus have previously been published by Rorer,⁴ Petch² and Stevenson.⁶ The use of the green muscardine fungus has been studied in detail by Rorer⁵ who worked out the practical aspects of employing this fungus in the control of frog hoppers in sugarcane fields in West Indies. Work in this direction has been initiated in Bombay in co-operation with Shri P. V. Wagle, Crop Protection Officer, Sugarcane Research Scheme, Ahmednagar, by employing this fungus for controlling *Pyrilla* sp. in sugarcane fields.

The writers are highly thankful to Dr. M. J. Thirupalachar for help in identifying the fungus.

Plant Pathological Lab.,
College of Agriculture,
Poona-5,
July 28, 1952.

M. N. KAMAT.
M. K. PATEL.
G. W. DHANDE.

1. Butler, E. J. and Bisby, G. R., *The Fungi of India*, 1931. 2. Petch, T., *Trans. Brit. Myc. Soc.*, 1931, 16, 55-75. 3. Pope, S., *Mycologia*, 1944, 36, 343-50. 4. Rorer, J. B., *Agr. Soc. Trinidad and Tobago Proc.*, 1910, 10, 467-82. 5. —, *Board of Agric. Trinidad and Tobago, Circular* 8, 1913, p. 10. 6. Stevenson, J. A., *Dept. Agri. Puerto Rico*, 1918, 2, 19-32.

SEEDLING BLIGHT OF *SESBANIA*
GRANDIFLORA PERS.

Soon after the rains in August, 1950, a number of seedlings of *Sesbania grandiflora* Pers. were observed to be dying at Bapatla. The casualties amounted to about 90 per cent. of the seedling stand. Elongated or oblong cankers occurred at the collar region. These were 6 to 10 mm. in length. In a day or two, acervuli of a species of *Colletotrichum* developed on the cankers and the basal part of the stem. The acervuli were black, erumpent, with well-developed stromata and measured 80 to 205 μ in diameter. The setae were generally at the periphery, dark brown at the base, lighter coloured at the tip, straight or curved, septate and upto 164 μ in length. The conidia were unicellular, hyaline, falcate and measured 19.5-30.0 \times 2.7-3.6 μ . The fungus was isolated from germinating spores. On oats agar the mycelium was pale-greyish with abundant aerial hyphae and profuse development of black fructifications.

Seeds of *Sesbania grandiflora* were inoculated by steeping them in a suspension of the spores, and sown in sterilised soil. Twelve out of twenty seedlings died within three days of germination developing typical lesions and later, the fructifications of the fungus. The seedlings in the controls were all unaffected. In another experiment seedlings of *Sesbania* were inoculated by spraying a suspension of spores on the cotyledons and placed under a bell jar for 24 hours. Ten out of twelve seedlings developed water-soaked lesions on the cotyledons in five days. Within three more days the lesions extended to the hypocotyl and the seedlings were killed. Acervuli developed in profusion all over the hypocotyl and the cotyledons of the seedlings. The controls were free.

Comparison of the isolate with *Colletotrichum capsici* (Syd.) Butler and Bisby showed close morphological resemblance. Twelve fruits of *Capsicum annum* L. were inoculated with each of the isolates—the one from *Sesbania* and *C. capsici* isolated from *Capsicum* fruits. Suitable controls were kept. While all the fruits inoculated with the *Capsicum* isolate rotted within three days with profuse development of acervuli, only five of those inoculated with the *Sesbania* isolate developed small, water-soaked or brown, circular lesions in six days. Very few acervuli developed. The fungus was re-isolated in each case.

The culture obtained from *Sesbania* was maintained on sterilized *Capsicum* fruits for five generations and then inoculated on healthy green *Capsicum* fruits. There was rapid rotting

in ten out of twelve fruits with typical lesions. There was little difference from the rot caused by the *Capsicum* isolate. Conversely while the *Capsicum* isolate did not produce any symptoms on *Sesbania* seedlings immediately on isolation, after having been maintained on sterilized *Sesbania* stems for five generations, it caused the typical seedling blight in six out of twelve seedlings inoculated, while the *Sesbania* isolate infected eight out of twelve.

Ramakrishnan¹ has found that the parasitism of *C. capsici* is influenced by the substratum on which it has grown for a protracted period. The fungus under study exhibited a similar behaviour. Since morphologically it closely resembles *C. capsici* and is capable of infecting *Capsicum* fruits also causing typical symptoms, it is considered to be identical with *Colletotrichum capsici* (Syd.) Butler and Bisby.

I am grateful to Mr. T. S. Ramakrishnan, Government Mycologist, Coimbatore, for critically going through this note.

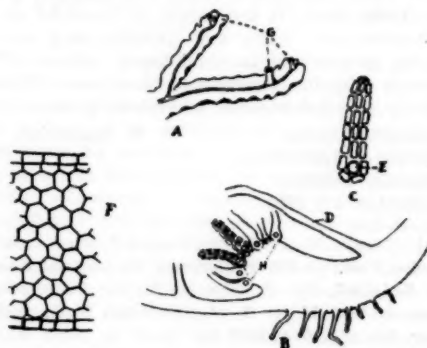
Ootacamund.
July 3, 1952.

K. V. SRINIVASAN.

1. Ramakrishnan, T. S., *Proc. Ind. Acad. Sci.*, 1947, 25, 15-27.

NOTES ON INDIAN HEPATICS

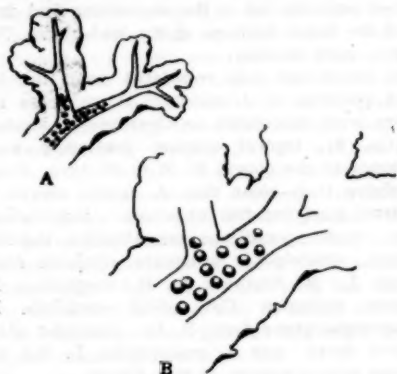
In the course of identification of the Liverworts collected by the author from Kathmandu, Nepal, in September 1951, it was found that the collection contained a material with the following notable characters:



A. Habit. B. L. S. Of Female thallus showing the position of Archegonia. C. An Archegonium enlarged. D. Involution. E. Egg. F. T. S. Thallus. G. Involution. H. Archegonia, in clusters.

Diocious, thallus thin in large patches, robust, medium to largish in size, green to reddish

brown, elongate sparingly dichotomously branched with linear segments of more equal breadth, mid-rib broad, conspicuous 10-12 cells thick, margin more undulate and one-celled. Internal cells wider than epidermal cells, 5-7 angled. Radiculate, rhizoids smooth-walled, numerous, scales absent. Involucres antical in acropetalous succession vertically directed upward, 2 mm., tubular forming a complete ring, cylindrical, mouth truncate, minutely crenate. Archegonia in cluster, upto 20 in number occurring in all stages. In all the material examined, ripe sporogonia were not found. The male fronds smaller than the female ones and less robust than the latter, 1.5 cm. to 2 cm. long by 1 cm. to 2.4 cm. broad. Apex bifid and slightly notched. Antheridia numerous, globose immersed in broad mid-rib in 2 to 3 rows.



A. Habit; Male thalli showing the position of antheridia. B. A portion of the same thallus enlarged.

Thus the material resembles *Pellia neesiana* (Gottsche) Limpr. described by Macvicar,³ as quoted by Kashyap² and also that by Pearson.¹ It has an additional feature—that of possessing involucres in acropetalous succession.

This is the first record of its occurrence from Nepal.

Dept. of Botany,
Patna University,
Patna,
February 28, 1952.

JWALA PRASAD SINHA.

1. Kashyap S. R., *Liverworts of the Western Himalayas and the Punjab Plains*, University of Punjab, Lahore, 1932. 2. Pearson, W. H., *The Hepaticae of the British Isles*, London, 1902. 3. Macvicar, *Students Hand Book of British Hepaticae*, 1926

NOTES ON TWO SYNCHYTRIUM SPECIES

A *Synchytrium* species parasitizing the leaves of *Millingtonia hortensis* Linn. f. and inciting the formation of tiny galls was collected near Bangalore. The galls were hypophyllous, slightly raised above the leaf surface as crateriform nodules (Figs. 1 & 2), greenish-yellow at the beginning and later turning dark brown in colour.

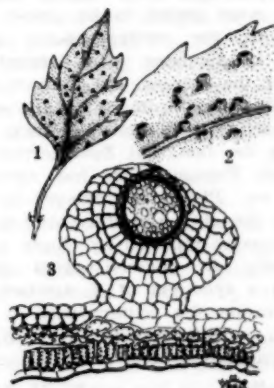


FIG. 1. Infected leaflet of *Millingtonia hortensis*, $\times \frac{1}{2}$. FIG. 2. Enlarged view of the galls, $\times 2\frac{1}{2}$. FIG. 3. Section through the gall showing the resting spore, $\times 100$.

Sections through the galls reveal the resting spores lodged inside the galls. No prothecium or sporangial formation has been observed. The sorus is entirely epidermal in origin, but due to the overgrowing of the surrounding host cells, a cylindrical gall 200-350 μ broad and 200-270 μ high, projecting above the epidermal layer is formed. At the level of the epidermis the gall is slightly constricted. There is a single resting spore in each gall. The host cells of the gall lining the resting spore on the sides and at the base are large and isodiametric. The layers of cells above the resting spore are small and thin-walled and collapse at maturity thereby releasing the resting spore. On the sides of the gall there are 3 to 4 layers of cells surrounding the resting spore (Fig. 3).

Mature resting spores are yellowish-brown, subglobose to spherical, 90-140 μ in diameter, thick-walled (wall up to 6 μ thick), and smooth (Fig. 3). Comparative studies with other *Synchytrium* species so far described indicate the present species is undescribed. The name *Synchytrium millingtonicolum* is proposed for its accommodation.

Synchytrium millingtonicolum sp. nov.

Galls on leaves, hypophyllous, simple, appearing as small crateriform tubercles. Resting

spores subglobose or spherical, yellowish-brown, 90-140 μ in diameter, wall 6 μ thick, smooth. Hab. on the leaves of *Millingtonia hortensis* Linn. f. Bangalore, leg. K. M. Safeeulla, 10-7-1952.

In a recent paper Gupta and Sinha¹ reported a *Synchytrium* on the leaves of *Phaseolus radiatus* L. as an undescribed species with the name *S. phaseoli-radiati* Sinha and Gupta. The galls were stated to be simple or compound, with the resting spores measuring 165-200 μ in diameter. In determining the identity of the species, the authors compared it with *S. phaseoli* Patel, et al., and found their species to be different. They, however, overlooked the fact that *Synchytrium ajrekari* Payak and Thirumalachar has already been reported on *Phaseolus mungo* by Payak² which has the same characters and is identical with the species reported by Gupta and Sinha. Consequently, *S. phaseoli-radiati* should be treated as a synonym of *S. ajrekari*.

In conclusion the writers wish to acknowledge their indebtedness to Dr. L. N. Rao for valuable suggestions and kind encouragement.

Central College,
Bangalore, and
Agricultural College,
Hebbal, Bangalore-6,
August 26, 1952.

K. M. SAFEULLA.

H. C. GOVINDU.

1. Gupta, S. C. and Sinha, S. *Indian Phytopathology*, 1951, 4, 7-9. 2. Payak, M. M., *Curr. Sci.*, 1951, 20, 103-04.

NEW HOST FOR XANTHOMONAS MALVACEARUM (SMITH) DOWSON

BLACK arm of cotton caused by *Xanthomonas malvacearum* (Smith) Dowson, is observed to be on the increase in this State. This disease is seed-borne but the pathogen also survives in the infected plant debris left in the soil. Consequently, secondary infection is possible from the latter source. It was suspected that the organism may be capable of parasitising other host plants also. Patel and Kulkarni³ have found out that this organism failed to infect seven different hosts belonging to *Malvaceae*. Brown and Gibson¹ have, however, found that *Thurberia thespesioides* A. Gray can serve as a host for this bacterium in Arizona. Palm²

has described a disease of *Eriodendron anfractuosum*, DC. caused by the same bacterium from Illinois.

In order to find out whether any of the common plants growing in the neighbourhood of the cotton fields serve as collateral hosts for this bacterium, inoculations were carried out with pure cultures of the organism on several plants belonging to *Malvaceae* and *Euphorbiaceae* and *Aristolochia bracteata* Retz. The suspension of the bacteria was smeared on both the surfaces of the leaves previously punctured by very fine sterilised pins and the plants were kept inside glass cages. Suitable controls were kept. Small water-soaked spots developed on the leaves of *Jatropha curcas* L. in 4 to 6 days. The spots increased in size upto 3 cm. across and ultimately turned brown. The midrib was also infected and this led to the shrivelling and drying of the distal portions of the leaf-blade. The controls were healthy.

The bacterium was reisolated from the infected portions of *J. curcas*. When these reisolates were inoculated on *Gossypium hirsutum* L. (Co. 2), typical angular leaf-spots were developed in the course of 10 to 12 days. From the above it is clear that *J. curcas* serves as collateral host for this organism. Inoculations under similar conditions on *Abutilon indicum* G. Don., *Aristolochia bracteata*, *Hibiscus rosa-sinensis* L., *H. ficulneus* L., *H. micranthus* L., *Pavonia zeylanica* Cav., *Sida cordifolia* L., *Cryptostegia grandiflora* R. Br., *Jatropha glandulifera* Roxb. and *J. gossypifolia* L. did not produce any symptom of the disease.

I am grateful to Sri. T. S. Ramakrishnan, Government Mycologist, for his valuable guidance and help in carrying out these experiments.

Division of Mycology,
Dept. of Agriculture,
(Govt. of Madras),
Lawley Road P.O.,
Coimbatore,
October 1, 1952.

N. V. SUNDARAM.

1. Brown, J. G. and Gibson, F., *Phytopathology*, 1923, 13 (10), 455-57. 2. Palm, B. T., *Ibid.*, 1932, 22 (10), 867-68. 3. Patel and Kulkarni, *Indian Phytopathology*, 1951, 3 (1), 51-63. 4. Smith, E. F., "An Introduction to Bacterial Disease of Pl. nts." W. E. Saunders, Cy., Philadelphia.

REVIEWS

Trigonometry, Plane and Spherical. By Lloyd L. Small. (McGraw-Hill Book Co.), 1952. Pp. 406. Price \$3.75.

The first eleven chapters give a very good and rigorous treatment of elementary plane trigonometry. By introducing rectangular and polar co-ordinates, trigonometric functions are defined for any angle, and their signs discussed. The definitions are accurate and the proofs are rigorous and refreshing. An adequate number of problems of varied type and difficulty will be found in the book, and due emphasis is laid on numerical computation work. The subject-matter extends up to De Moivre's theorem and Euler's formulae for the circular functions.

The arrangement of the subject-matter differs considerably from that usually found. Thus the relation between the sine and the cosine of an angle is taken up in as late as the fourth chapter, on p. 95, while problems on heights and distances including three-dimensional problems are considered in Chapter 2. This will not work out as a handicap in the hands of the teacher who uses his discretion to rearrange the subject-matter in his own way, if he chooses. Under the prevailing Indian conditions, the cost of the book will preclude its being widely used as a text-book. But the student and the teacher who can afford to use it will be amply rewarded by the accurate and rigorous treatment of the subject presented in the book.

Two chapters on the solutions of right and oblique spherical triangles, though brief and well-written, serve little purpose for our Intermediate syllabuses. The book concludes with a chapter on logarithms, and five-figure tables of logarithms, trigonometric functions, etc.

C. N. S.

Elements of Physico-Chemical Calculations for Students of Science and Pharmacy. By M. L. Schroff. (Pindars Ltd., 7, Lower Rawdon Street, Calcutta 20), 1952. Pp. 242. Price Rs. 12-8-0.

The volume under review is the second edition of the book first published twelve years ago. It is too elementary to be of use to any science students beyond the Intermediate stage. While the subject-matter of each chapter is presented in clear language, most of the information can be had from much less expensive pub-

lications. Chapter IV has a misleading title which makes a reader expect problems outside the narrow part of the subject actually covered. The chapter on Indicators in Acidimetry and Alkalimetry also shows the limitation of the volume with statements like the following: "A normal solution of Na_2CO_3 will contain one molecule of Na_2CO_3 if the solution is to be titrated using phenolphthalein." The distribution of material and the space devoted to each topic suggests that the volume may be of use to students of pharmaceutical chemistry.

S. V. A.

Polarography. Vol. I. By I. M. Kolthoff and James J. Lingane. (Completely revised and augmented edition.) (Interscience Publishers, New York, London), 1952. Pp. 420. Price \$9.00.

The second edition of this invaluable book appears eleven years after the first edition. The revision has kept pace with the very rapid progress in the field of polarography, resulting in two volumes (instead of one in the first edition), wider in scope and with many new illustrations of great interest. Most of the chapters have been rewritten and several new chapters have been added. Many of the illustrative data are taken from the original communications from the authors' laboratories.

The book under review consists of two parts, the first (15 chapters) dealing with the theoretical principles, and the second (14 chapters) with instrumentation and technique. In Part I, the fundamental theory of the diffusion current is treated on the lines developed by Ilkovic, MacGillavry and Rideal. The treatment of Lingane and Loveridge for modified Ilkovic equation correcting for the sphericity of drops is a valuable addition to this chapter. The various factors that affect the value of the diffusion current are critically examined. Separate chapters have been devoted to deal with the migration current, electrocapillary curve of mercury, residual current, maxima, polarographic behaviour of simple and complex metal ions. Thermodynamic significance of half-wave potential is given in great detail. The application of various formulations is shown with numerous illustrations making it easy even for the beginner to apply these formulations to his systems. The

authors rightly stress the inadequacy of the present knowledge regarding the phenomenon of maxima. The recent contributions (1951) of Hañs and Stackelberg could have been referred to in this connection. The complicated question of hydrogen discharge is clearly reviewed. Chapters V, VI and XV are a valuable addition to this Part. In Chapter V, the authors summarize the general characteristics of non-aqueous media in polarography, with reference to methyl and ethyl alcohols, ethylene glycol, glacial acetic acid, liquid ammonia, and molten salts. In Chapter VI, some unusual phenomena in diffusion current like interfering electrode reactions, the water current, the hydrolysis current, compensating anodic-cathodic diffusion current are discussed. The effect of reaction rates on polarographic waves described in Chapter XV is very interesting. The contribution on the catalyzed hydrogen peroxide waves indeed opens up a new field of investigation.

In Part II, the authors explain the various circuits used in polarography. Chapter XVIII is a new addition and contains a summary of various experimental factors which are of significance in practical polarography. This is an addition, especially useful for beginners.

In dealing with the theoretical revision of the Ilkovic equation, the derivations of Strehlow and Stackelberg and Kambara and Tachi could have been added. In the reviewer's opinion, the Breyer-Gutmann technique and a critical review of the development of A.C. Polarography would have been very welcome. The addition of an index (to both the volumes) would also have greatly facilitated easy reference. The book is perhaps priced a little too high. The presentation, coming as it does from those who have contributed substantially to the progress of this branch of analytical chemistry, is as masterly as any would desire.

M. R. A.

Medicinal Chemistry, Vol. I. By Alfred Burger. (Interscience Publishers, Inc., New York, and Interscience Publishers, Ltd., London), 1951. Pp. xviii + 577. Price \$10.0.

This is a borderland subject, an understanding of which requires a close acquaintance with the different branches of chemistry and biology in addition to specialised knowledge in one branch. Nevertheless, Alfred Burger has made a successful attempt in the book under review to present a connected story of the chemistry, biochemistry, therapeutic and pharmacological action of natural and synthetic drugs.

Out of the 28 chapters in this volume, the first six deal with general topics like (1) Introduction, (2) Historical Development of Medicinal Chemistry, (3) Relation of Chemical Structure and Biological Activity, (4) Physical Properties and Biological Activity, (5) Biological Study of Drugs, and (6) Restricted Response of Cells to Drugs. The remaining 22 chapters deal with drugs arranged according to their usage.

The table in the chapter on historical development, listing some important dates in the development of medicinal chemistry during the last 100 years, serves as a reckoner of the strides made by medicinal chemistry. In the chapter on relation of structure to activity, the relation in homologous series and also the effect of the functional groups are described. Theories of isosterism, physical properties of isosteres, their reactivity, classification and biological activity are discussed in the chapter on physical properties and biological activity. In the chapters dealing with the different classes of drugs, in addition to a description of the chemistry of the drugs, attempts have been made wherever possible to describe theories of action as well as tests and methods of application.

The material presented here has been extensively documented. However, in the opinion of the reviewer, inclusion of an exhaustive bibliography at the end of each chapter would have enhanced the usefulness of the publication to the research worker to whom this book will be very helpful.

The publication is bound to be very well received by all those interested in medicinal chemistry.

B. H. IYER.

Medicinal Chemistry, Vol. II. By Prof. Alfred Berger. (Interscience Publishers, New York and London), 1951. Price \$10.

The second volume of this treatise of medicinal chemistry deals mainly with the chemotherapeutic agents for bacterial, protozoal, fungal and viral infections, except for a chapter on the chemistry and medicinal uses of hormones. The theories of metabolite antagonism, dyestuffs in chemotherapy, the sulphanamides, the anti-malarials, chemotherapy of acid-fast infections, the antibiotics and a few other chemotherapeutic agents are the fields of study covered in this volume.

In a book covering such varied groups of subjects, it is almost impossible to review completely the vast field of recent discoveries of

new drugs, their chemistry, action and uses. This ambitious attempt in surveying and co-ordinating the researches in the chemistry, biochemistry, therapeutics and pharmacological actions of both synthetic and natural drugs has unfortunately led to the superficial survey of many aspects of the problems discussed. But, providing as it does, a sufficient number of important references, the volume serves the purpose of an able guide, and should form an useful companion to all research workers in medicinal chemistry.

M. SIRSI.

Chemical Physiology of Endo-parasitic Animals.

By Theodor von Brand. (Academic Press Inc., 125 East, 23rd Street, New York), 1952. Pp. x + 339. Price \$7.50.

This is the first book of its kind published on the physiological aspects of parasitology. The purpose of the book, as has been stated by the author in the preface, "is to review and integrate the relevant literature which, because scattered in many periodicals and contained, relatively often, in papers dealing primarily with non-physiological topics, is sometimes difficult to locate". This has been more than achieved by the author. The subject-matter is explained lucidly and every statement made is supported by proper authority. The author has published many papers on the subject and is himself an authority in the field.

The book is divided into three parts. Part I deals with the chemical composition of parasites and has a chapter each on the following subjects: (1) Dry Matter and Inorganic Substances, (2) Carbohydrates, (3) Lipids, (4) Proteins, (5) Physiologically active substances such as vitamins, etc., (6) Pigments, (7) Toxic Substances. The chemical composition of the parasites, published so far, is given in tabular form and discussed.

Part II is on the Metabolism of Parasites and includes chapters on the metabolism of (1) Water, (2) Inorganic Substances such as Phosphorus, Chlorides, etc., (3) Carbohydrates, (4) Lipids, (5) Proteins, and (6) Gaseous Exchanges, (7) Oxygen Relationships, (8) Growth Requirements. The last chapter contains most of the work so far attempted for culturing parasites outside the body of the host. At the bottom of page 199, it is stated that the "report of Lamy (1948) that *E. invadens* could be cultivated in the presence of small pieces of organs, but in the absence of bacteria or bacterial extracts, requires confirmation". The paper by M. J. Miller in the *Canadian J. of*

Comp. Med. of November 1951, confirming the findings of Lamy was, perhaps, not in the hands of the author at the time of the preparation of the book.

Part III deals with the chemical host-parasite relationship and has chapters on (1) Nutritional Relationships Between Parasites and Hosts, (2) Physiological Basis and Metabolic Consequences of Parasitic Anemias, (3) Metabolic Disturbances in Parasitic Infections, (4) Endocrinological Relationships, and (5) Chemotherapy from a Physiological Point of View. The last chapter gives a rational explanation of the action of certain antiprotozoal and antihelminthic drugs and the problem of drug resistance is also discussed.

A complete bibliography is given at the end of each chapter, which makes it a very useful reference book. A chapter could have been included on the immunological and serological aspects of parasitic infections. The reviewer, however, feels sure that all those interested in the subject will be thankful to the author for bringing together the available literature in one compact book with lucid explanations wherever needed.

N. S. K. RAO.

Man in Evolution. By M. R. Sahni. (Orient Longman Ltd., Bombay, Calcutta and Madras). Pp. 10 + 272. Text-Figs. 116. Map 1. Price Rs. 8-12-0.

The great merit of Sahni's *Man in Evolution*, a charming little book, lies in the fact that it leads to a synthesis and meaningful interpretation of many scattered taxonomic, biological, geological, climatological and geographical data. Such a work should help to encourage collaboration between sciences, such as biology, geology, anthropology, geography and meteorology. This book is equally useful for archaeologists and pre-historians. Though the book has been primarily written for 'young students of science, particularly those aspiring to their Bachelor's Degree in Geology, Anthropology or Zoology', it has a much wider interest and even mature scientists in any branch of the above-mentioned sciences will find it useful as a reference book, when dealing with borderline problems.

Like many other palaeontologists, the author finds a key to the organic evolution from the simplest organism to man in the geological changes and climatic fluctuations on the earth on the one hand and the quality of adaptiveness on the part of the organisms concerned in

the process of evolution on the other. For instance, on page 77, he says: "This struggle for survival in a changed environment carried on by means of adaptation is believed to be the main factor in evolution. It results in the appearance of new species." In fact, the author has throughout the work established a chain of cause and effect phenomena. He has repeatedly shown that specialization leads to the extinction of a race while generalised organisms, with greater powers of adaptability, have through the ages provided the materials which led to further and further advances.

The book is written throughout in an easy style so that the information contained in it becomes readily assimilable. The scientific data are well regimented so that they are easily comprehensible to a science student of average intellect.

Though the reviewer is not in a position to examine very critically the innumerable data presented in the book and the observations recorded thereon, he feels that the zoological portion of the book could be improved considerably.

An alphabetical, and not an analytical, bibliography, covering 8 pages of small type, is given at the end. Though choppiness of the text has been avoided by not quoting references in the text, it would have been helpful for students if a list of references had been given at the end of each chapter or the bibliography had been divided into subject-sections.

The get-up of the book is very pleasing and the cover decorative. The gifted family of Sahni, for Mrs. Sahni and Miss Kamini Sahni have helped the author in many ways, deserve the gratitude of science students. The publishers, Messrs. Orient Longmans Limited, are to be congratulated on bringing out a book of this high standard at a low price of Rs. 8-12-0.

S. L. H.

Five-Membered Heterocyclic Compounds with Nitrogen and Sulphur or Nitrogen, Sulphur and Oxygen (Except Thiazole). By L. L. Bambas, Parke, Davis and Company. (Interscience Publishers, Inc., New York), 1952. Pp. 403. Price \$14.00.

The fourth volume of the series of monographs on the chemistry of heterocyclic compounds, edited by Dr. A. Weissberger of the Eastman Kodak Company, maintains the standard of thoroughness and scholarship set by the previous volumes in the series. The scope of the book is slightly wider than the title, the selenium analogues of the sulphur

compounds also being included. Except that the literature after 1948 has not been covered, the treatment is comprehensive, and since a relatively circumscribed field has been chosen it has been possible to list nearly every known compound of the specified types. Chemical Abstracts and Ring Index systems of nomenclature have been used, and the chemical names have been supplemented by clearly printed structural formulae. Of special interest is Table VI which lists "controvertible (questionable?) names and structures of some 1:2:4-thiadiazoles occurring in the literature".

The three parts into which the book is divided deal with (I) thiadiazoles and selenium analogues; (II) five-membered rings containing, N, S, Se or O in addition to one S and one N; and (III) isothiazoles and selenium analogues. Each part is subdivided into small sections covering closely related classes of compounds. The historical development of the chemistry of each class is followed by a tabular survey of individual compounds, their structures, methods of preparation, physical properties and references to the literature. In some of the sections the historical account is followed by a somewhat scrappy discussion, the theoretical aspects of which are superficial. Thus it is surely inadequate to limit the consideration of the alleged similarity of the thiadiazole and thiophene ring systems to the arithmetical requirement for a "sextet" of electrons. The comparison of 1:2-benzisothiazoles and naphthalene made by Fries in 1927 is cited, but the inclusion of isoquinoline and a more fundamental approach to this subject would have been profitable. Further, isolation of the "discussion" of the chemistry of a given class of compound from the main presentation is of doubtful advantage. From this and other points of view the book under review is not easy reading. Numerous compounds and a mass of data have been assembled systematically and in the briefest possible space; the result is a valuable book of reference, but not a readable treatise which seeks to give an overall picture of a field of heterocyclic chemistry.

Naphthasultam and many of its derivatives are mentioned together with the relevant patents, but an omission is a reference to BIOS 987, in which the preparation of naphthasultam and from it a vat dye (Indanthrene Yellow 6GD) is described. Some of the formulae in p. 232, 264, 327 need to be corrected.

Although the paper, printing and binding are superb, the price seems excessive for a volume of 403 pages.

K. V.

Snakes (in Tamil). By M. Ekambaranadhan. (M. Swaminathan, Gopalapuram, Madras 6), 1952. Pp. vi + 40. Price Re. 1.

This small book deals with the life and habits of the Indian snakes in general for the benefit of laymen and students of the primary and secondary schools.

There are 35 illustrations and a frontispiece photograph. Throughout the book the author has taken special pains to disprove many popular beliefs and superstitions commonly associated with snakes in India. The style is very lucid and the book provides laymen and school students ample opportunities to learn something about snakes. The author deserves praise for bringing out a very informative book at such a low cost of Re. 1 only. His forthcoming books as announced in the cover page, should also prove to be of immense use in popularising zoology and harnessing it for the benefit of the public.

K. C. J.

Books Received

A Hand Book of Shellac Analysis, 2nd Edition. By M. Rangaswamy and H. K. Sen. (Indian Lac Research Institute, India), 1952. Pp. 144. Price not given.

Advanced Statistical Methods in Biometric Research. By C. Radhakrishna Rao. (John Wiley & Sons, New York; and Chapman & Hall, London), 1952. Pp. xvii + 390. Price not given.

Biologie D'Anopheles Gambiae. By M. H. Holstein. (Organisation Mondiale D'Eha Sante, Geneve), 1952. Pp. 176. Price 10 sh.

Television. By F. Kerkhof and W. Werner. (Phillips Technological Library), 1952. Pp. 432. Price not given.

Metallurgical Equilibrium Diagrams. By Hume-Rothery, J. W. Christian and W. B. Pearson. (Institute of Physics), 1952. Pp. 305. Price 50 sh.

Molecular Architecture of Plant Cell Walls. By R. D. Preston. (Chapman & Hall), 1952. Pp. 211. Price not given.

Vacuum Technique. By Arnold L. Reiman. (Chapman & Hall), 1952. Pp. ix + 432. Price 18 sh.

Physiological Approach to the Lower Animals. By T. A. Ramsay. (Cambridge University Press), Pp. v + 148. Price 15 sh. net.

Rocket Propulsion. By Eric Burgess. (Chapman & Hall), 1952. Pp. 229. Price 21 sh. net.

Annual Review of Biochemistry. (Annual Reviews Inc., Stanford), 1952. Vol. 21. Pp. 781. Price \$6.

SCIENCE NOTES AND NEWS

Chemical Control of *Orobanche* on Tobacco

Sri. N. Prasad, Plant Pathology Section, Agricultural Institute, Anand, writes as follows: Recently King, Lambrech and Finn* reported on the herbicidal properties of a new chemical, 2, 4-dichlorophenoxyethyl sulphate, while working on tomato, asparagus and sweet corn. They found that this chemical could check weeds in any of the above-mentioned crops without causing any apparent injury to either of them. This chemical known commercially as Crag Herbicide I is produced by the Union Carbide and Carbon Corporation of New York.

From our experiments, it appears that in 2, 4-dichlorophenoxyethyl sulphate, we have a chemical which is selective in action so far as *Orobanche* is concerned but not affecting tobacco and it may be thus useful in controlling this important plant parasite of tobacco.

* King, Lawrence, J., Lambrech J. A. and Thomas, P. Finn, *Contrib. Boyce Thompson Inst.*, 16 191-208.

International Cancer Research Conference, Bombay

Meetings of the International Cancer Research Commission will be held in Bombay from 30th December 1952 to 2nd January 1953. Dr. V. R. Khanolkar, Director, Indian Cancer Research Centre, Bombay, and President of the International Cancer Research Commission is organising two symposia on (1) Geographical Pathology of Cancer in Asia, and (2) Chemotherapy of Cancer, to be convened during the session of the Commission in Bombay. Medical men and scientific workers interested in these symposia are cordially invited to attend. Further details will be announced later.

International Electrotechnical Commission

India has, for the first time, been elected member of the Committee of Action of the International Electro-Technical Commission (IEC) for a 9-year term along with Norway and Netherlands succeeding France, Sweden

and Switzerland. The national responsibility for the IEC work is now borne by the Indian Standards Institution (ISI) and the Indian National Committee (INC-IEC) has Shri S. A. Gadkari of the Central Water and Power Commission as its President.

Essay Contest

An essay contest has been announced by the Indian Dairy Science Association, the subject of the essay being "Production and Marketing of Ghee in India". The last date for submitting the essay is 31st January, 1953. Any other information required can be obtained from The Hony. Secretaries, Indian Dairy Science Association, Hosur Road, Bangalore-1.

Award of Research Degree

The University of Nagpur has awarded the Degree of Doctor of Philosophy in Zoology to Mr. K. K. Tiwari for his thesis on "The Indo-Burmese Fresh Water Prawns of the Genus *Palæmon*".

Power Sources in Arid Zones

Plans for developing sources of power in arid zones through wind and solar energy are being discussed by UNESCO's Advisory Committee on Arid Zone Research. The Committee will also consider the setting up of an Arid Zone Development Centre.

UNESCO's aims in this field are to discover and make available the experience and expert knowledge gained from the experiments and projects carried out in many parts of the world and to help the creation and extension of research stations for the study of Arid Zone problems. (UNESCO.)

Central Bureau of Education

Organised as a service agency through which the Ministry can be of assistance to the States as well as to educationists and educational institutions, the Central Bureau of Education consists of six sections dealing with Publication, Information, Statistics, Audio-Visual Aids, the Central Education Library and the Central Secretariat Library. The publication work of the Bureau includes research and compilation, preparation and printing of pamphlets, exchange of Bureau's publications with outside agencies and distribution within India of gift-books received from abroad.

Shellac-Coated Earthenwares

The application of lac to non-porous surfaces such as those of earthenwares has been made possible as a result of investigations at the Lac Research Institute, Ranchi, Bihar. A film of shellac on earthenware resists the action of water, soap solution (hot and cold), salt, mineral and vegetable oils as also of dilute mineral and organic acids. Such coated vessels can conveniently replace costlier materials such as porcelain or glazed earthenware or glass, for storing articles of every-day use like common salt, molasses, oils, pickles, etc. Lac being non-poisonous, no harmful effect would result from its use. Another important application of lac-coated pots has been found in their use for collecting and storing palm juice from palm trees. The sealing action of the lac film prevents the fermenting enzymes from getting lodged in the pores of the vessel; this prevents or slows down fermentation processes. With usual precautions these vessels could be used repeatedly.

IMPORTANT NOTICE

In view of the transfer of the Editor to Madras, it is requested that all articles, letters, reviews, books for review, exchange journals, corrected proofs and other items intended for publication in CURRENT SCIENCE may kindly be addressed to:

Professor G. N. Ramachandran,
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Department of Physics,
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